NEW YORK SEATTLE

MOTORSHIP

Devoted to Commercial and Naval Motor Vessels

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TRIALS OF NEW AMERICAN MOTORSHIPS

EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

(Trade Mark Registered)

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

Vol. VI — New York, U. S. A., December, 1921 — No. 12

Cable Address—Freemote, New York

Ensuring a Future for America's Merchant-Marine

Practical Proposal for the Conversion of Ships in a Manner That Should Be Satisfactory to Shipowners, Government and to the General Public

LAST month "Motorship" suggested that something should be saved from the flotsam and jetsam now lying in our harbors, left there by the tidal waves of war and post-war conditions and by our various Shipping Boards. It was also stated that the nation will be willing to spend some additional money if it could be demonstrated that a number of these vessels can be converted to first-class economical motorships capable of competing against foreign fleets. "Motorship" has devised a program which was briefly touched upon in our last issue, which, if followed, undoubtedly will have the approval of the entire country, altho some modifications or improvements, of course, may be necessary.

This policy has been submitted to a number of leading shipowners and shipbuilders, and all regard most favorably the plan outlined. In fact, an executive of one of the largest shipbuilders in the country stated that he considered that it was the only feasible plan, and that undoubtedly something along these lines must be done. Also that it may be the means of saving the shipyards, tiding them over until such time as international commerce causes a demand for new ship construction.

"Motorship's" plan is that the Board shall dispose of a large number of the idle steel hulls—particularly the 8,800 ton boats—to shipowners at a very low cost, on the understanding that the present uneconomical oil-wasting steam-machinery be removed, and sold abroad if possible, and replaced by modern up-to-date marine Diesel engines—preferably of American construction. The tentative price of the hulls is to be figured out in accordance with the estimates for the cost of conversion of each individual ship and balanced after the work is completed, enabling the shipowner to decide if he will go ahead. The costs will vary according to the ship.

All conversional work shall be carried out at the expense of the shipowner in conjunction and in co-operation with the Technical Department of the Shipping Board, or preferably with a special committee of experts appointed by the Government, who shall supervise and pass upon the plans for the machinery and for the conversion and on the costs of the work, leaving the shipowner to an extent free to select the type and make of machinery to be installed; also the shipowner shall be allowed to select the shipyard at which the work is to be undertaken.

There are two principal methods of making the change to these ships at moderate cost and with few structural changes. One is to instal Diesel-engines of the long-stroke, slow-speed

PLAN FOR REGENERATION OF AMERICA'S MERCHANT MARINE

Turn best and most suitable ships over to shipowners at low cost, on understanding they convert them to economical Diesel or Diesel-electric power under supervision and jurisdiction of Government's experts and at their own expense within limits.

Shipowners to select type of engines, and to secure bids for Conversion from shipyards.

Tentative price shipowner pays for hulls to be based on these conversion estimates, the Government Committee to pass upon plans and control price to within reasonable limits. Easy terms to be given.

Work to be carried out, if approximate cost mutually satisfactory, and ship taken over by ship-owner.

Definite price to shipowner to be finally based upon actual cost, the Government guaranteeing that same shall not exceed current prices foreign shipowners have to pay for ships in their countries.

Use of Section II Jones Act to assist financing.

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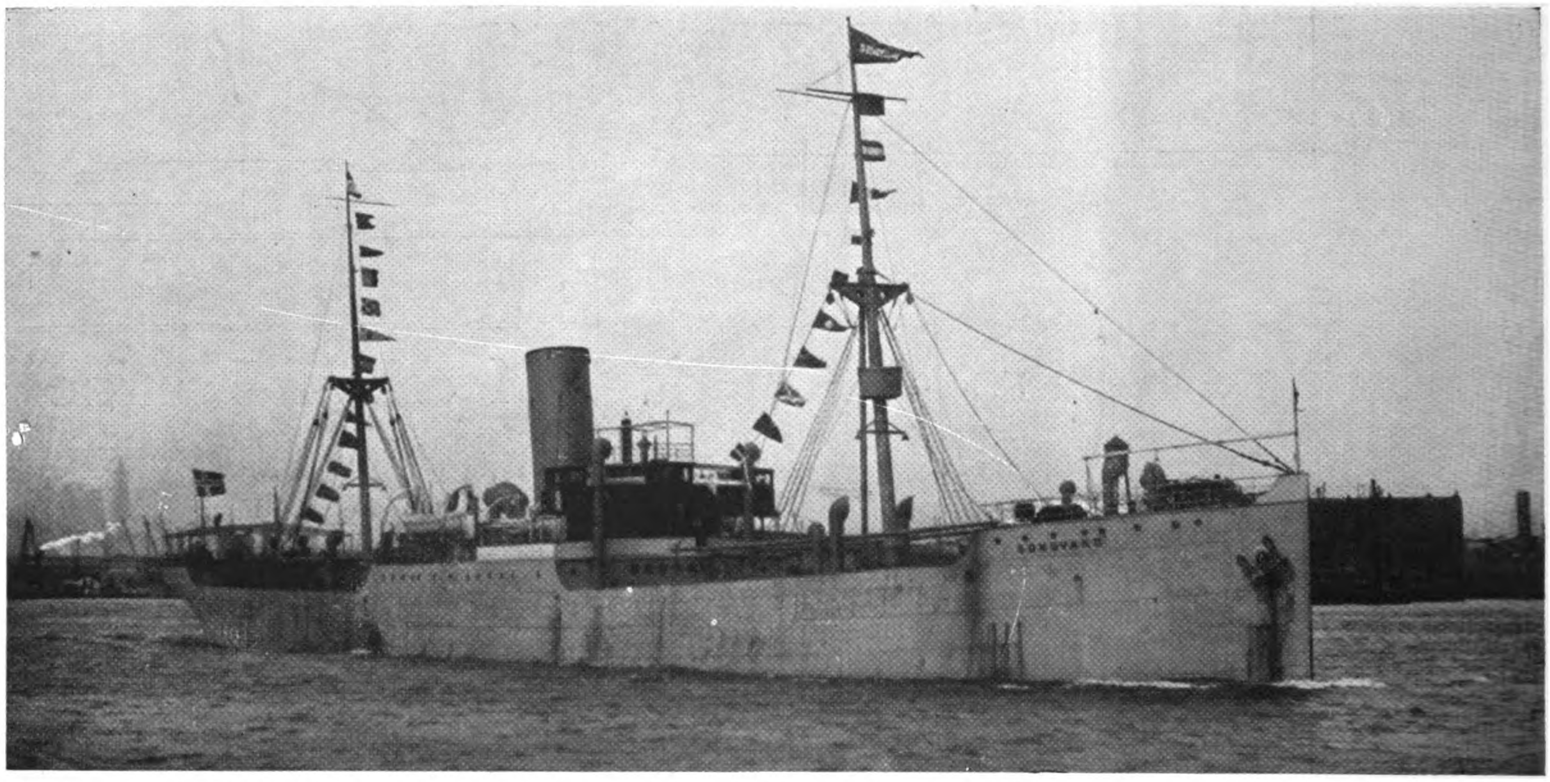
Diesel and Diesel-electric power will make idle American ships economical, and will enable them once more to take their place carrying American products to all parts of the world



"SONGVAND" one of three single-screw steamers successfully converted to single-screw Diesel power. They are owned by S. O. Stray & Co. of New York. Operating details were given in our issue of January last

type—several excellent designs of which can now be obtained to develop their power at from 80 to 90 revolutions. The alternative is to instal Diesel-electric drive. Existing moderate-speed direct-drive engines will do for some types of ships. Furthermore, the question of reduction-gear drive should be investigated. In many cases we believe that the present inadequate cargo-handling machinery on the deck will have to be changed to electric power in order to be able to handle cargo rapidly at any extremely low cost, and to reduce stand-by charges in port.

It is quite possible, however, that the cost to the shipowner will not be sufficient to necessitate the Government providing any financial aid, if the hulls are sold at a sufficiently low figure on the stipulation that the machinery change be done. It will be a simple matter to make arrangements whereby the final price of the hull should be determined afterwards, and based upon the actual cost of the installation, figuring out the tentative hull price from the estimates from the shipyards.

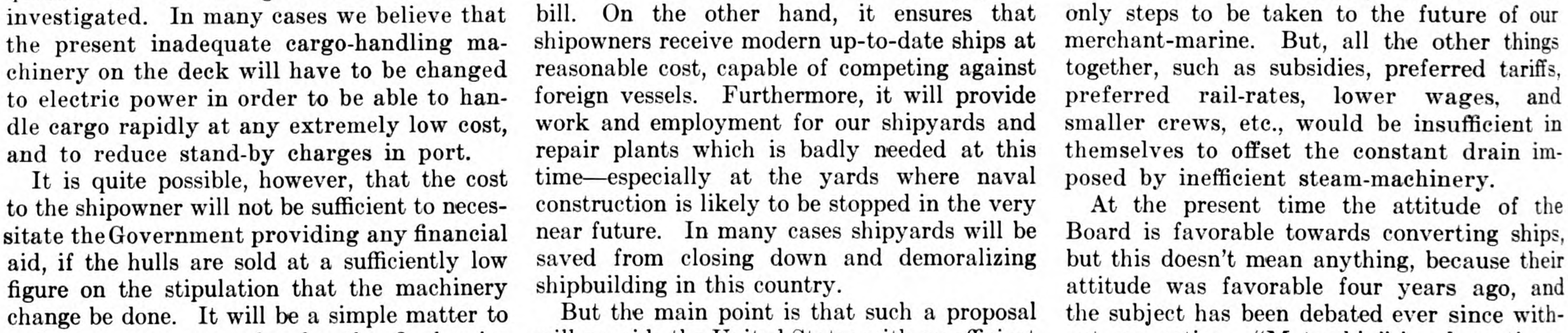
The Shipping Board shall be empowered by Congress to guarantee that when each ship is completed, the total cost to the shipowner, including the hull and conversional work, also any reconditioning or repairs necessary, shall not exceed the current cost that modern steam or motorships can be purchased by European shipowners; after having made a certain allowance for the difference in exchange-rates. To aid the conversion of steamers already owned by American shipowners, a subsidy should be given by Congress equal to about half of the cost of the work.

That the conversion plans will be carried out under the supervision of the Shipping Board, or Special Committee, will ensure that a shipowner does not spend too much money on vessels and make the Government pay the bill. On the other hand, it ensures that shipowners receive modern up-to-date ships at reasonable cost, capable of competing against foreign vessels. Furthermore, it will provide work and employment for our shipyards and repair plants which is badly needed at this time—especially at the yards where naval construction is likely to be stopped in the very near future. In many cases shipyards will be saved from closing down and demoralizing shipbuilding in this country.

But the main point is that such a proposal will provide the United States with an efficient and thoroughly up-to-date mercantile fleet capable of taking cargo at the lowest possible rates, but with a reasonable operating profit when pressed by severe competition. The country is too deeply involved—too many billions have been spent, to let our entire fleet rust. Probably Clause Eleven of the Jones' Act could be changed to give the Shipping Board the necessary authorization to make these arrangements and furnish any money, should any be necessary. In Clause Eleven the provision of $25,000,000 per annum for five years is legalized for aiding shipowners to build motorships. The tide of public thought is swinging strongly in this direction, and any evasion by the Board or Congress will only temporarily postpone the inevitable, meanwhile shipyards will go bankrupt, and more ships will be laid up, and the nation's expense-bill will increase.

We realize that building motorships or converting steamers to Diesel-power are not the only steps to be taken to the future of our merchant-marine. But, all the other things together, such as subsidies, preferred tariffs, preferred rail-rates, lower wages, and smaller crews, etc., would be insufficient in themselves to offset the constant drain imposed by inefficient steam-machinery.

At the present time the attitude of the Board is favorable towards converting ships, but this doesn't mean anything, because their attitude was favorable four years ago, and the subject has been debated ever since without any action. "Motorship" is advocating a safe, simple and feasible plan, which should be adopted with any necessary modification. Weeks pass into months and months into years, with remarkable progress meanwhile being made abroad, and now the Board wishes to wait for the return of their solitary motorship "William Penn" from a voyage around the world, half of which she already has covered in splendid time. For all the good of its intentions the Board is still lost in a maze of petty technicalities, so "Motorship" puts forward this plan, believed to be sound in theory and practical in operation, for immediate consideration and adoption.



"V. J. TIMIRIASEFF," one of five Weyland Diesel-engined passenger and freight motorships built by the Russian Government

Turbine-Electric or Diesel-Drive

Discussion of the Installations in the "Cuba" and "San Benito"—Its Comparison with Light-Weight, Heavy-Duty Diesel Machinery

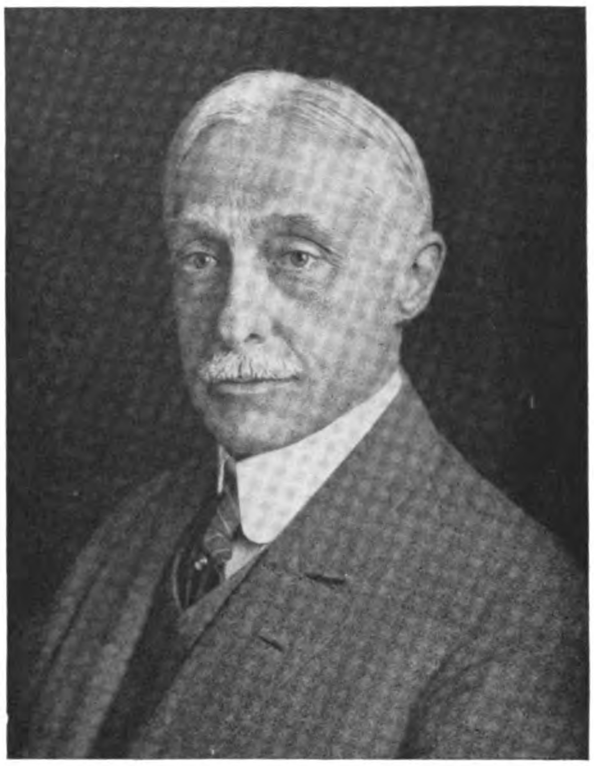
By ELMER A. SPERRY
President, Sperry Gyroscope Company, New York

AFTER having been shipmates for a day of inspection on the "Cuba," which was heralded as a very great simplification of the turbo-electric ship proposition, I must confess that I came away very much disillusioned as to the plant being simple. There was nothing short of an amazing array of machinery, including auxiliaries, and the electrical control which, with the synchronous system, I had expected to have disappeared almost completely, was still very much in evidence and really formed a large component part of the equipment. However, the main object had been attained in that the deficiencies of the non-reversible turbine were covered, even though it takes a lot of expensive equipment and high transmission losses to do it.

I remember that in the "Cuba" I made some measurements, spread-out a newspaper on one of the out-of-the-way elevated positions and sat down, pondering the mass of machinery that was spread out before me. While there I visualized a complete light Diesel equipment with duplex engines together with all necessary electric-sets for lighting, etc., occupying in toto but a small portion of this engine-room space alone and weighing actually less than the water in the boilers. I was impressed with the marvelous simplification when using Diesels, where practically no auxiliaries are necessary. Taking the boiler and engine room, I found that no less than 28,000 cu. ft. of space could be released as cargo space and that no less than 7½ times the useful tonnage of the ship is devoted to the propelling plant compared with the requirement in the case of the Diesels, at twice the first cost and probably four times the cost of installation. This, of course, wholly outside the fuel-consumption of from three to four times the amount required for the same power with Diesels, and, what is more interesting still, with the enormous combustion chambers of the new light engines the same quality of bunker oil that was being fired under the boilers.

These facts I have pondered over much since my visit to the "Cuba," so I was glad to avail myself of an invitation to visit the "San Benito" in order to compare the "Cuba" with another "synchronous" plant of about the same size as well as the same type, built in England. Here I had expected that the greater experience of England would have been able to realize the simplicity claimed for this electric type of propulsion. I was accompanied by some men who have devoted a lifetime to engine-room equipment and operation of fleets of ships at sea.

When we finally descended into the engine-room and commenced to familiarize ourselves with the detail of the equipment crowded into this room, we looked at each other and agreed that here again we failed to find the simplicity that was expected. Every available foot of space seemed to be occupied by machinery. One had to climb over and on top of one after the other to get about. In fact, there were so many auxiliaries that their proper accessibility was difficult. For instance, there seemed to be no way to get at the condenser tubes for replacement or very readily even for inspection. And what was most surprising of all was the relative location of boilers, turbo-generator condensers and the array of auxiliaries on the one hand, and the motor at a point very remote aft, on the other, in a compartment by itself which seemed very difficult of access. I doubt if the motor-room would be visited very often or very willingly, especially in heavy seas. It seemed that the "Cuba" arrangement in this point was superior, where both motor and generator were in one room, though the "San Benito" seemed to have the simpler control equipment.



ELMER A. SPERRY
Inventor of the Sperry gyroscope, Sperry high-pressure marine oil-engine and many other valuable devices

Far be it from me to discourage electrical equipment. I have been closely identified with electric development all my life. In 1879 I built my first generator and the lighting system that went with it, which had a wide use, and I have set it to many a useful task in the years that have followed. I am of course a thorough booster of "do it electrically," but it must be remembered that Mr. Edison himself on more than one occasion has pointed-out that sometimes electricity is dragged-in by the ears when there are other methods that are better suited. Of course we should not allow the mere desire to employ electricity to cause us to make this kind of a mistake.

I am constantly struck with the complexity and maze of machinery, fittings, pipe connections, etc., that go to make the ensemble that one now encounters in the engine rooms of steamships.

As an engineer I cannot but believe that the hour has struck on this ever increasing complexity. A well-known engineer, in speaking on this subject recently, stated that a new steam auxiliary was born every day and that he was literally putting down a separate building to accommodate them. It seems to me that marine engineers should stop long enough to think where this is leading them. Especially is this true in face of what light and low-cost Diesel plants would be able to do, where there are practically no auxiliaries and where the fuel is burned drop by drop, directly driving powerful pistons, instead of the wasteful bulk firing, with all its attendant losses, indulged in wherever steam is employed. The single matter of doing away with the boilers and their troubles and the boiler auxiliaries and their troubles is of paramount importance as an item by itself.

The Engineering Experimental Station Bulletin No. 19, by Dr. Norman, states that the Government should intervene and suppress the enormous waste of the irreplaceable liquid-fuel supplies, especially in view of the fact that from 1/4 to 1/5 (including the standby losses) only may be consumed for the same shaft horse-power delivered with equal reliability and with very great reduction in engine room personnel and expense.

I was present when M. L. Requa, former Fuel Administrator of the United States, stated most emphatically at the recent Petroleum Congress in Washington that "steam equipment on board ships should from now on be regarded as obsolete."

Now that the heavy-duty Diesel equipment has arrived at a capital charge not exceeding that of steam, and at only a fraction of its weight and space requirement, there is no farther excuse for not adopting the vastly simplified and more powerful engine-room equipment, placing our engine rooms completely aft, thus releasing along with the most valuable space in the ship, hundreds of tons of weight, thousands of cubic-feet in space, and quadrupling our cruising radius with a given bunker capacity, and this in the double bottom.

This will help us to keep our fleets in service in competition with those of any other nation and our flag on the seven seas.

ELMER A. SPERRY, E. D.

NEW TYPE OF SHIP'S MOTOR TOW BOAT

Thirty-Foot Tugs Carried on Shipping Board Vessels

AT many ports on the coast of Africa the water is not sufficiently deep to permit steamers going alongside of docks; the cargo is lightered from ship to shore in boats handled by natives. Much delay and uncertainty has resulted from this method, and the United States Shipping Board has equipped steamers running to these ports with a small motor tow-boat which is carried on the ship's davits and lowered over the side on arrival in Africa. For handling a half-dozen heavily-laden boats thru rough surf, often bumping against the side of the ship and other lighters a sturdy boat is required. Strong davits are also needed to safely handle a boat so much heavier than the usual life-boat. The situation has been well met in the six craft designed by the Shipping Board's Department of Maintenance and Repair, and constructed by the New York Yacht, Launch and Engine Co., of Morris Heights, New York. Our illustration shows one of these boats on official trials.

Each of these tugs is powered with a Frisco-Standard twin-cylinder 7 in. by 9 in. motor operating on kerosene and developing about 21 h.p. at 385 R.P.M., at which speed a 34 in. diameter by 28 in. pitch 3-bladed Columbian propeller drives the boat 8.6 statute miles per hour. Controls for boat and engine are provided under the steel shelter, from which one man operates the boat. The following are the principal particulars:

Length over all	30 ft.
Breadth, extreme	7 ft.
Draft, extreme	3 ft. 6 in.
Weight, total	7 tons
Power	21 B. H. P.
Speed	8.6 st. miles

One of the U. S. Shipping Board motor launches

Such serviceable little tow boats powered with surface-ignition oil-engines should be more often found on our waterways, especially for working around piers, terminals, etc., where a small but powerful motor tug can work quicker than the present large steam-tugs. On canals and rivers passing thru cities where several bridges have to be negotiated, small, low motor tugs prove of great advantage in efficiently handling scows, barges and lighters, it being unnecessary to wait for bridges to be opened as does the steam-tug with her high funnel. Also, fuel-consumption in the motor tug stops when the day's work stops, while the steam-tug must consume fuel thru the night, keeping up steam. One man operates the motor-tug, with a deck hand to handle lines, as compared with a captain, engineer, fireman and deck hand on a steam tug. The majority of small motor-tugs require relatively more power than this Ship-Board ship's motor-tug, of course, but for many purposes a boat exactly like this is eminently suited.

Trials of Standard Oil Diesel-Engined Tanker "H. T. Harper"

HERE are at least four reasons why the Standard Oil Company's new steel vessel "H. T. Harper" is one of the noteworthy merchant-ships of the year. In the first place she is the largest Diesel-driven tanker built in the United States; secondly she is the largest motorship of which both propelling engines and hull were built on the Pacific Coast; thirdly she is the largest American vessel with Werkspoor-type Diesel engines in service; fourthly she shows remarkable economies and gains in cargo-space compared with a sister steamer owned by the same company. For the latter reason we draw the especial attention of all domestic concerns operating tankers on the High Seas.

Trials of this interesting ship were carried out with success, as the accompanying record will confirm, on October 27th last. She has been built to American Bureau classification, whose requirements for Diesel-engine construction are even more stringent than Lloyds. Her owners are the Standard Oil Company of California, San Francisco, Cal., and she was built by the Moore Shipbuilding Company at Oakland, Cal., while her main Werkspoor Diesel-engines were constructed under license from the Werkspoor Company of Amsterdam, Holland, under supervision of Dutch experts, by the Pacific Diesel Engine Co. also of Oakland, who control exclusive Werkspoor rights on the Pacific Coast of the United States. Her three auxiliary Diesel engines were built by the Dow Pump & Diesel Engine Co. of Alameda, Cal., under license from Willans, Robinson & Co., of Rugby, England, while the electrical machinery was furnished by the General Electric Company of Schenectady, N. Y.; the winches, capstans and windlass are by Allan Cunningham of Seattle, Wash., and the steering-gear a production of the Hyde Windlass Co. of Bath, Me.

Pacific-Werkspoor Engines of New Motorship Develop 3,018 *I.H.P.* (2,203 *Shaft H.P.*) *Although Only Rated at* 2,260 *I.H.P.* (1,700 *Shaft H.P.*)

Thus in this ship are incorporated the skill and knowledge of domestic and foreign concerns whose rank is second to none in the particular branch of the marine industry each is a part of, and the owners no doubt have a vessel which in reliability and economy, will be a distinct advance over any of their present tanker fleet, with the possible exception of their smaller motor-tanker "Charlie Watson," which has similar makes of Diesel engines to the "H. T. Harper," and which has been giving consistent service without trouble since she was placed in service.

Some time ago the New York Shipbuilding Corp. of Camden, N. J., built the steam-driven tanker "El Segundo" to the order of the same owners, namely the Standard Oil Company of Cal., and in regard to general dimensions she is practically a duplicate of the "H. T. Harper." But the difference in machinery has made a vast difference in the carrying capacities and fuel-consumptions, as will be seen from the following comparison table for the information in which we are indebted to the courtesy of the builders of the two ships in question. As it happens, the New York Shipbuilding Corp. is also a constructional-licensee of Werkspoor, so the data following herewith, no doubt will be of considerable value to them. They have kindly checked the following data of the "El Segundo" and certified it as correct. Our figures on the "H. T. Harper" have been checked by her builders.

	Steamer El Segundo	Motorship H. T. Harper
Loaded displacement	7,586 tons	7,713 tons
Light displacement	2,604 tons	3,016 tons
Cubic cargo-capacity of holds	222,132 cu. ft. (oil)	228,250 cu. ft. (oil)
	7,826 cu. ft. (dry)	26,672 cu. ft. (dry)
Total	229,958 cu. ft.	254,922 cu. ft.
Capacity fuel-bunkers	4,846 bbls.	3,586 bbls.
Carrying-capacity (with 30 days fuel-supply on 22½ ft. dft.)	27,000 bbls.	29,100 bbls.
Weight of complete engine-room machinery, including propellers and shafting	390 long tons	330 long tons

No two ships, of course, are even exactly alike, but it will be seen that the "H. T. Harper" is several hundred tons heavier than the steamer, but this is not due to the Diesel machinery as the two main-engines only weigh 220 tons together, compared with 300 tons for the steam-engines and boilers of the "El Segundo." But it will be noted that the motorship has a larger carrying-capacity by 2,100 barrels on a trans-Atlantic or trans-Pacific round voyage, the exact gain in hold-space being 24,964 cubic feet. Here it is worth while pointing-out once more as to the misleading nature of the term "dead-weight capacity" in denoting the carrying ability of a vessel, because the "dead-weight capacities" of these ships at loaded draft are as follows:

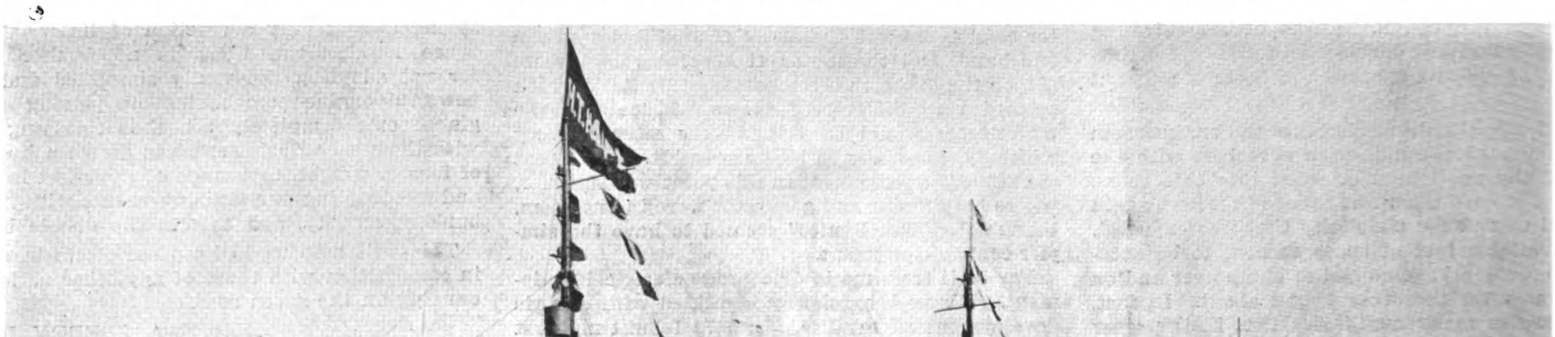
	Steamer El Segundo	Motorship H. T. Harper
Dead-weight capacity	4,982 tons	4,697 tons

The deadweight of the above steamer is distinctly greater than that of the motorship, nevertheless she cannot carry so much cargo. But shipowners should bear in mind that they sometimes unwittingly purchase ships at "so-much per dead-weight ton," or at least use the definition as a base. If this was done in the present cases it would make the motorship more expensive than the steamer per ton, whereas she probably was actually cheaper per net-cargo-ton capacity. The term "deadweight-capacity" became decadent with the advent of the motorship and should no longer be used. With freighters this is even more important than with tankers, because of greater cubic-capacity gains. In accordance with the cubic-capacity of the main and summer tanks, the cargo-capacity of the "H. T. Harper" is 6,087 tons at 37.5 cubic feet per ton.

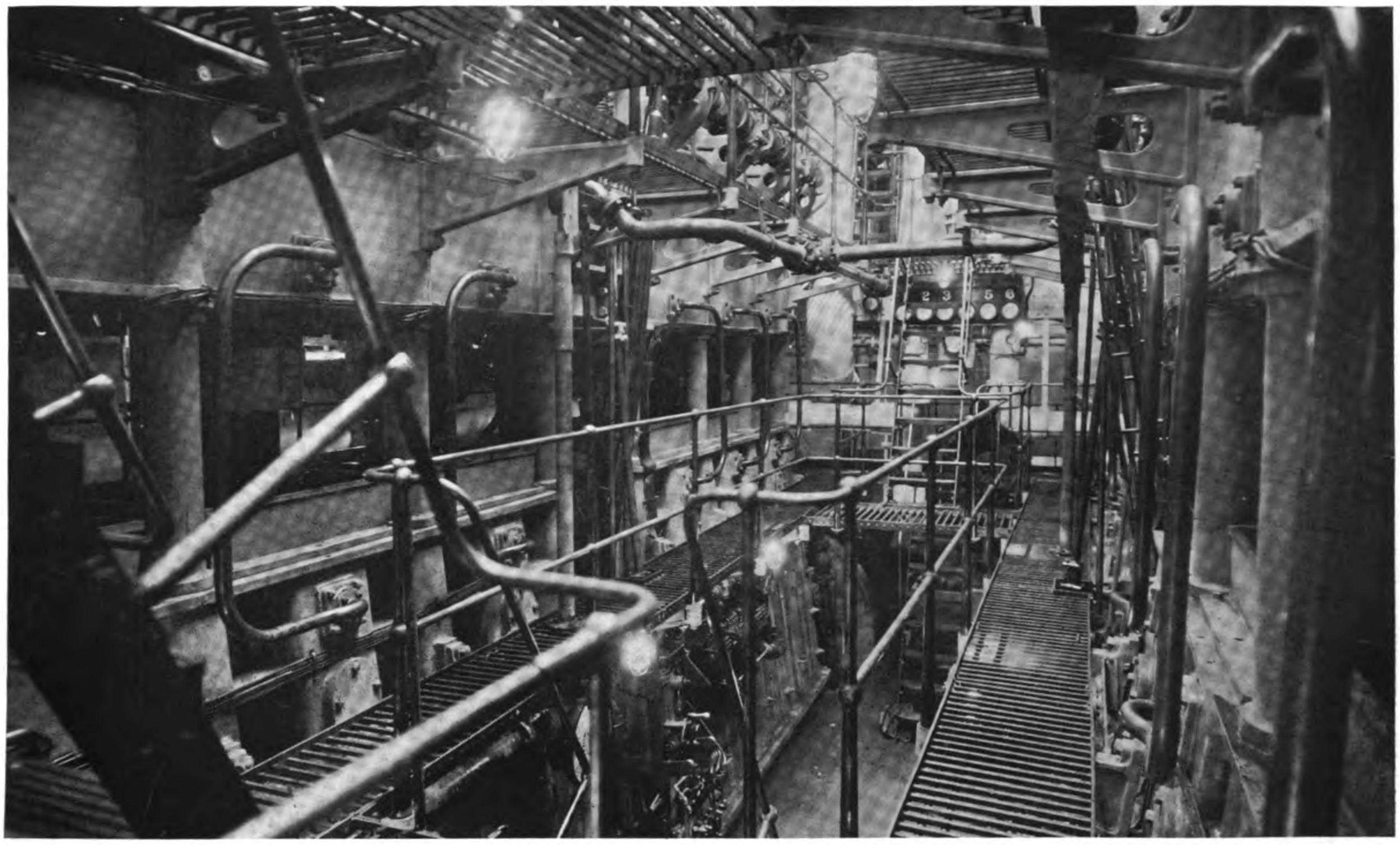
The leading dimensions of these ships are almost identical and are as follows:

	Steamer El Segundo	Motorship H. T. Harper
Length (O. A.)	343 ft. 4 in.	342 ft.
Length (B. P.)	330 ft.	330 ft.
Breadth (M. D.)	46 ft.	46 ft.
Depth (M. D.) to spar-deck	27 ft.	26 ft. 11¾ in.
Loaded draft (Mean)	22 ft. 5½ in.	22 ft. 5¾ in.
Cruising radius	7,300 nau. miles	20,000 nau. miles
Block co-efficient at load line	0.780	0.790
Co-efficient at midship section	0.975	0.985

Also the power of these two ships is almost the same, although the steam-engines turn at a lower speed and swing bigger propellers, so theoretically should drive the vessel faster.



Standard Oil Company's new Werkspoor Diesel-engined tanker "H. T. HARPER"

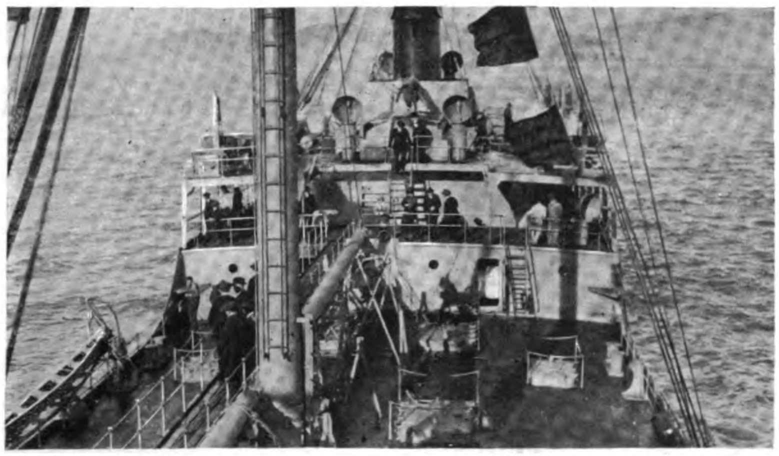


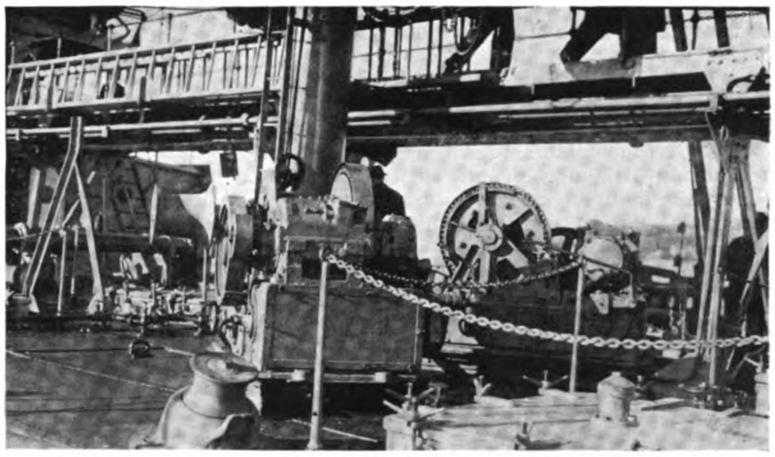
View of engine room of "H. T. HARPER" showing the cylinder-box, entablature, and frames of one of the main Pacific-Werkspoor Diesel engines; also the space between the cylinder-box and entablature into which the pistons can be lowered.

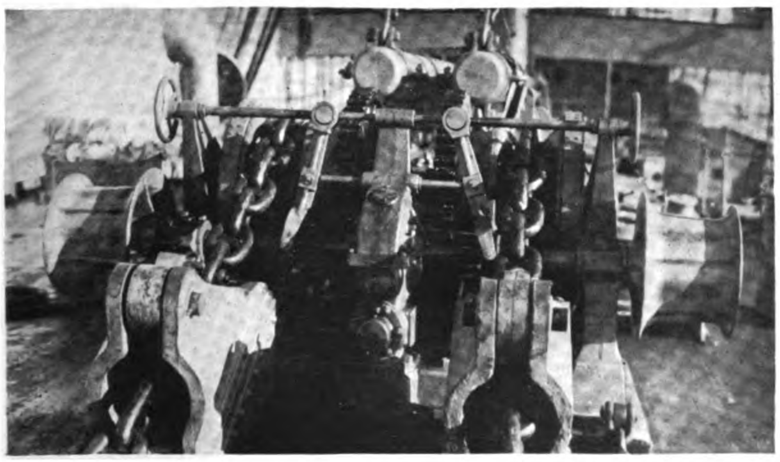
	Steamer El Segundo	Motorship H. T. Harper
Designed shaft horsepower	1,650 H. P.	1,700 H. P.
Rated indicated H. P. of main engines	1,900 H. P.	2,260 H. P.
Engine-speed	91 to 95 R. P. M.	135 R. P. M.
Power developed on sea trials	?	3,018 I. H. P. (2,203 shaft H. P.)
Power of three auxiliary Diesel engines	(Nil)	550 B. H. P.
Designed loaded speed of ship	10 knots	12 knots
Mean draft on trials	?	21 ft. 3 in.
Trial speed of ship (mean)	?	11.8 knots
Daily fuel-consumption (24 hrs.)	23 to 24½ tons	7½ tons
Propellers	15 ft. dia. by 13 ft. pitch	11 ft. dia. by 10 ft. pitch, with 30.55 sq. ft. proj. area.

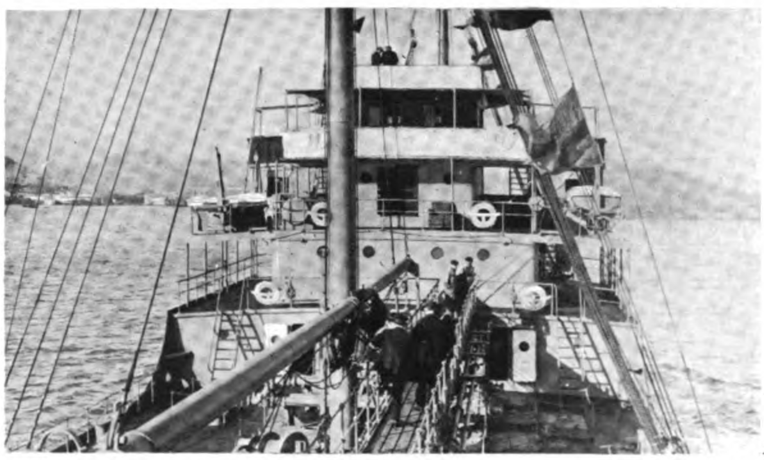
We understand that the designed speed of the motorship was 12 knots, but consider that this is higher than should have been expected. For instance, the designed speed of the steamer "El Segundo" was only 10 knots loaded, although several hundred tons lighter on the same dimensions and of the same shaft h.p. at lower revolutions. Therefore, we should think that the trial speed of 11.8 knots for the motorship "H. T. Harper" is most excellent, particularly as it was accomplished on one-third of the amount of fuel. The latter fact should cause all shipowners to deeply ponder.

Of one thing we are assured; namely, the average sea-speed of this motorship during the next year will be much better than that of the steamer, because it will be more consistent, due to the virtual absence of propeller-racing, and because the speed will not drop each four hours just prior to the change in watch. This "often-overlooked" factor is of importance in the ship's earning power. As a matter of fact the "H. T. Harper" averaged 11.305 knots on her round maiden voyage of 1,570 nautical-miles. We refer again to the speed of this ship later in this article.





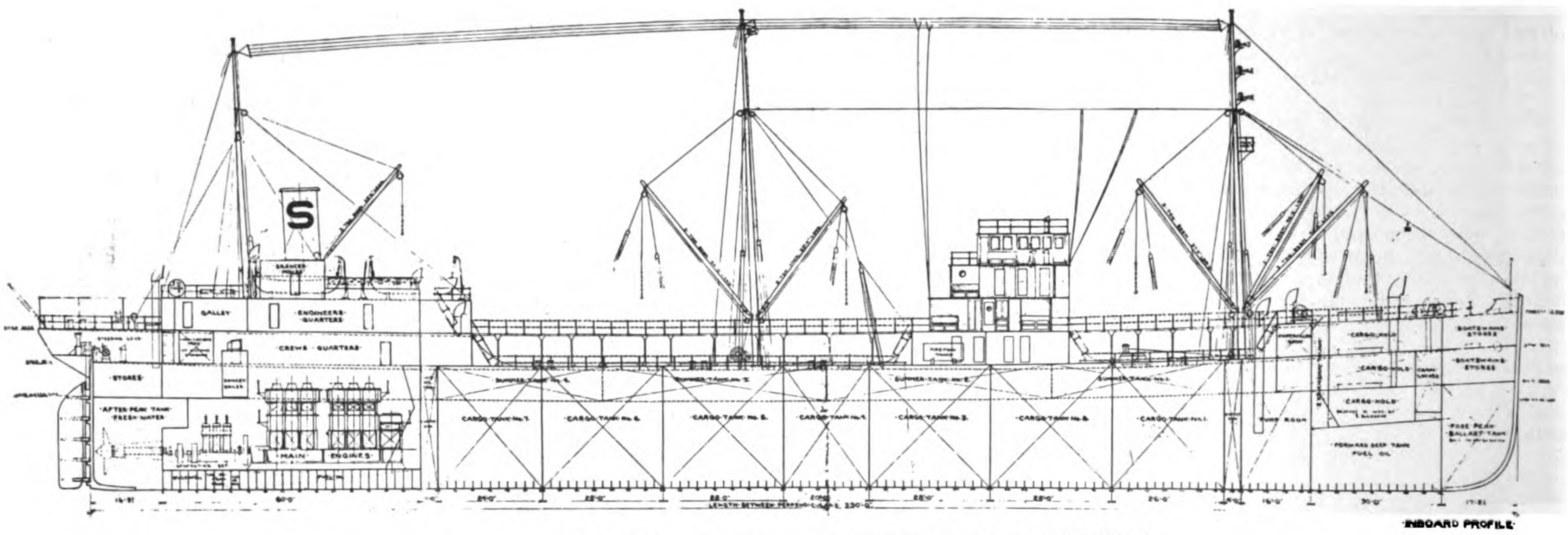




SCENES ON THE MOTOR-TANKER "H. T. HARPER"

Looking from midship-house aft. **Allan-Cunningham electric winches.**

Anchor windlass and chain-stoppers. **Looking forward from poop.**



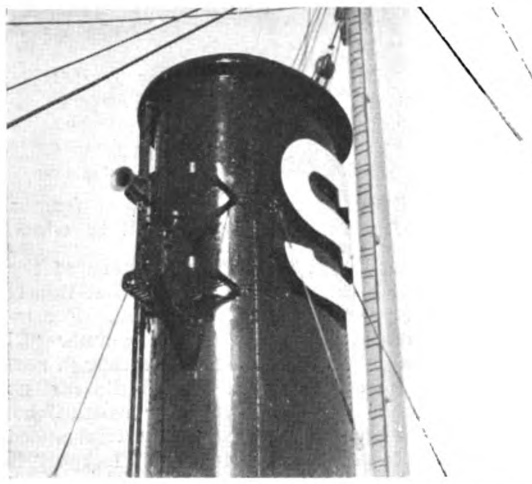
Arrangement plan of motor-tanker "H. T. HARPER"

Let us now turn to the space occupied by the machinery of these respective ships. In the case of the motorship a total of 60 ft. is given over to the engines and auxiliaries, all the fuel being carried in double bottoms and in tanks right forward. Whereas, in the steamer the engines take-up 40 ft. and the boilers 24 ft. while forward of these spaces is a deep-tank for fuel, rendered desirable by her greater fuel-consumption. This it will be seen from the drawings is 22 ft. long by the width of the ship. Thus we get the following:

	Steamer El Segundo	Motorship H. T. Harper
Space occupied by propelling machinery and deep tank	86 ft.	60 ft.

As regards fuel-consumptions, we have before us a copy of the records of the motor-tanker "H. T. Harper" on her sea-trials. We note that the two main-engines together with the two 200 b.h.p. auxiliary engines consumed 127.8 gallons per hour. (42 gallons = 1 barrel; 6.67 barrels = 1 ton.) On the shop tests of the main engine boiler-fuel oil of 16 degrees Baumé was used.

Seeing that the main engines averaged 2,203 shaft h.p. and the two auxiliary Diesels about 200 b.h.p. each, we have a total power developed during trials of 2,600 b.h.p. (we presume that the 150 b.h.p. auxiliary Diesel was not running). The two main-engines consumed 128 gallons of fuel-oil in 1 hour 23 minutes, or 92½ gallons per hour. The grade of fuel is not included in the report, so we cannot figure-out the exact shaft h.p. hour consumption. The latter is given in the report as 0.45 lb. But, if the builders took the total fuel-consumption and divided the same by the power developed by the main engines, it is not quite correct, because the total consumption should be divided by the total power of all the units developing power. This will make the b.h.p. hour-consumption lower than that given, especially as the auxiliary Diesels also were economical. These



The siren on the "H. T. HARPER'S" stack

points we would like to have cleared-up by the builders in our next issue. The fuel oil and water capacities of the ship are as follows:

FUEL-OIL CAPACITY

	Bbls.
Deep tank, P. & S.	2,010
Aft coff., P. & S.	720
Dbl. bottom, P. & S.	856
Total F. O.	3,586

LUBRICATING-OIL CAPACITY

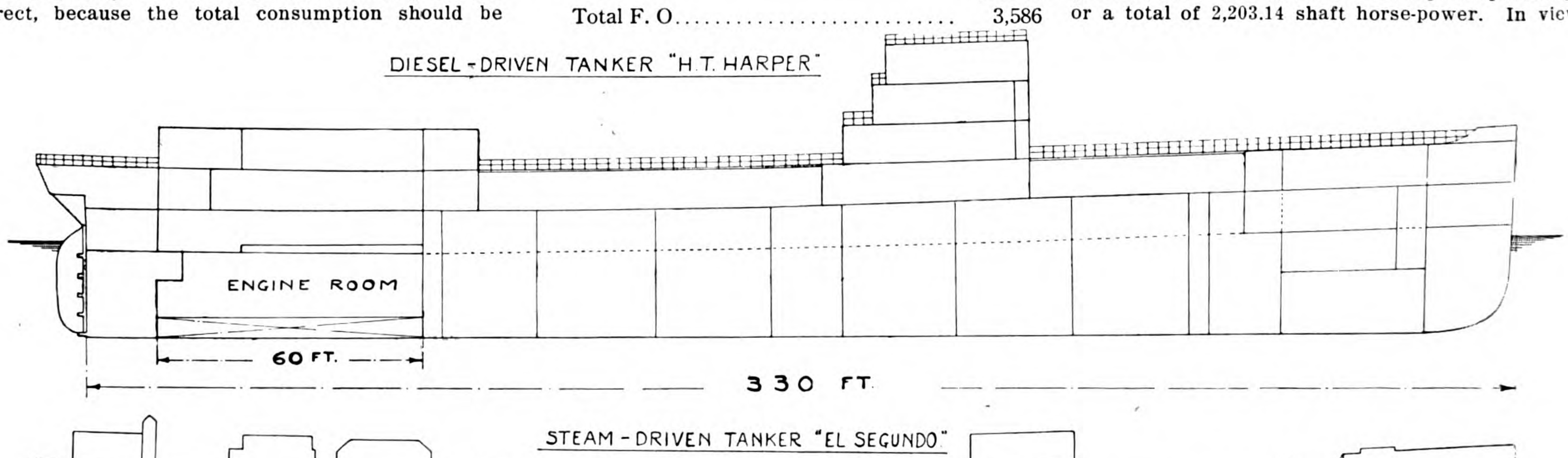
	Gals.
Wing tank, P. & S.	5,680
Drain tank, No. 1 P. & S.	857
Drain tank, No. 2 P. & S.	2,121
Total L. O.	8,658

FRESH-WATER CAPACITY

	Gals.
Fore peak	21,320
After peak	21,140
Culinary tanks (2)	3,000
Gravity tanks (3)	2,100
Total F. W.	47,560

Some oil companies are more or less opposed to the use of electrical-equipment for operating the cargo-pumps of a tanker; but this can now be arranged with as much safety as with steam, even when the ship carries very light oils. In the case of the "H. T. Harper," the switchboard is so arranged that it is impossible to start the cargo-pumps before the blower-motor of the forced draft system is started. This is accomplished by means of a time relay, set so that there must be 15 seconds delay after starting the blower-motor before the cargo-motors can be started.

We now will deal with the propelling machinery. These are twin six-cylinder Werkpoor four-cycle type Diesels, of the direct-reversible, cross-head, air-injection design, 520 mm. (35.433") cylinder bore, by 900 mm. (20.472") piston-stroke designed to develop 850 shaft h.p. (1,150 i.h.p.) each at 135 r.p.m. But, it will be noted that on trials starboard engine averaged 1,638 i.h.p., and the port engine 1,380 i.h.p. respectively, both at 135 revs. per minute. At 73% mechanical-efficiency this gives 1,195.74 and 1,007.4 brake h.p. respectively, or a total of 2,203.14 shaft horse-power. In view



Showing the difference in machinery spaces of the Standard Oil Co.'s Diesel and steam driven tankers "H. T. HARPER" and "EL SEGUNDO"

of this excellent power it is no wonder that a speed of 11.8 knots was averaged on a 21′ 3″ mean-draft. So we consider that great credit is due to both the hull and engine builders. As a matter of fact we think that more powerful engines are really required to regularly turn her two large propellers at 135 r.p.m. and that engines incapable of developing considerably more than their designed output of 850 b.h.p. could not have driven them up to that speed on the trials. We think that with the present propellers about 120 revs. and say 10¼ knots, will be very good indeed if maintained in service with A1 reliability. It will be interesting to know the average sea-speed that has been maintained by the "El Segundo" with her much lower propeller speed. Perhaps the owners will oblige with this information.

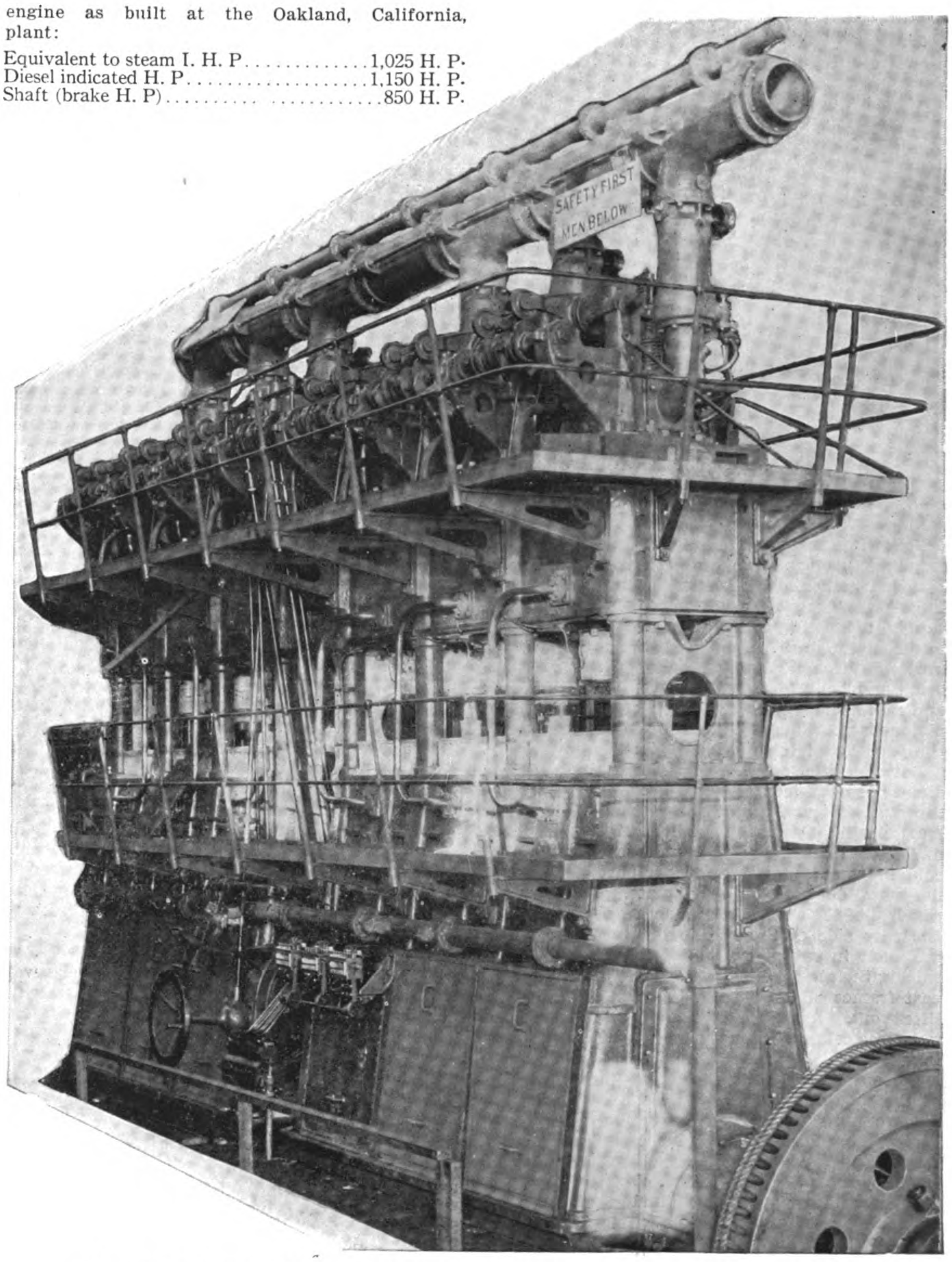
As mentioned, the two main engines were built by the Pacific Diesel Engine Co. under Werkspoor license, and were a twin-screw set similar to ten engines built to the order of the U. S. Shipping Board and now lying idle in storage for some unknown reason, instead of being publicly offered to shipowners, or installed in hulls.

When the Pacific Diesel Engine Company first decided to build Diesel motors, they figured that the success could be obtained more rapidly and at less expense if they adopted a well-tried-out and standardized European engine, and worked under license than if they designed and developed a Diesel of their own. At the same time the Pacific Diesel Co. considered that certain changes could be made in the European design which would produce conformity with present American practice without interfering with the general and well known characteristics of the original design which has given such excellent duty in many freighters and tankers. For instance, the Holland-built Werkspoor engine has the cylinder-beams carried on vertical steel-columns with diagonal steel bracing-rods, and the crosshead-guides are carried on heavy cast-iron columns at the back of the engine. Whereas in the American engine the diagonal braces have been deleted and the vertical steel-columns carried through cast-iron frames on both sides of the engine.

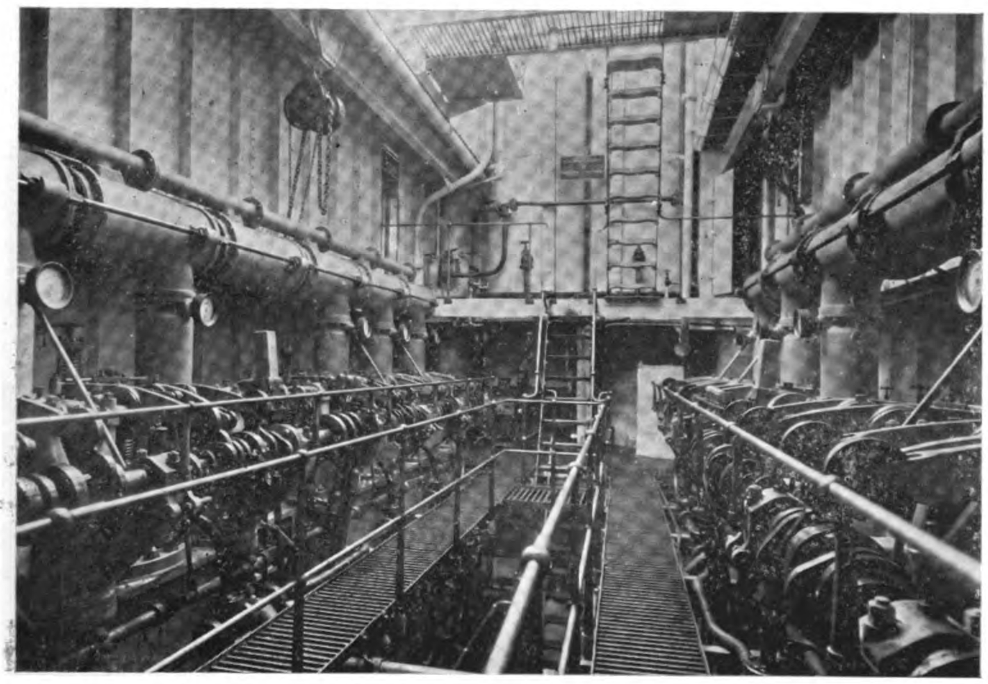
These changes were made by their own engineers in collaboration with three expert engineers from the parent factory in Amsterdam, and the results are a credit to American engineering. While for marine work the engineers at Amsterdam lean toward their own steel column design for cargo-ship installations, this combination cast-iron and steel column construction is to be found in their submarine-engine and in some of their stationary sets; also in their engines in the tankers "Sembilan" and "Vulcanus." So, strictly speaking, the American licensees have made a transfer of application rather than produced a new design, except for certain minor features.

The following are the main dimensions of the 850 shaft H.P. (1,150 Indicated H.P.) marine engine as built at the Oakland, California, plant:

Equivalent to steam I. H. P.	1,025 H. P.
Diesel indicated H. P.	1,150 H. P.
Shaft (brake H. P)	850 H. P.



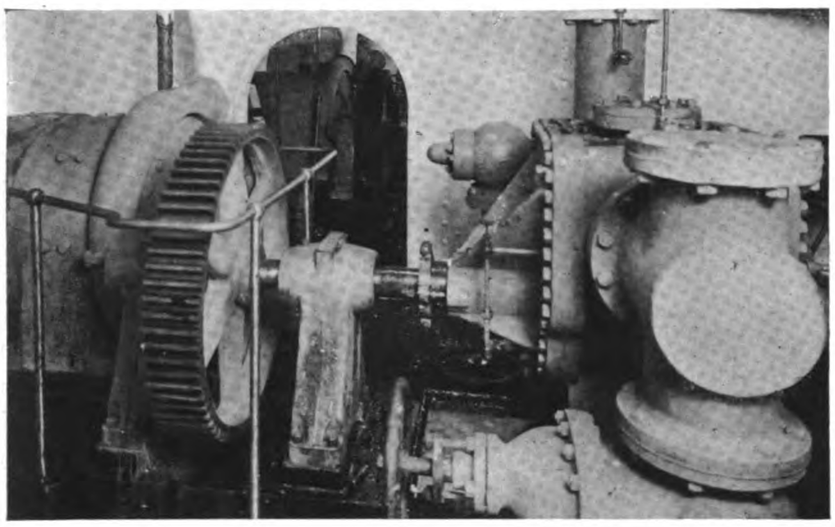
One of the twin Pacific-Werkspoor Diesel-engines of the tanker "H. T. HARPER"



Upper platform of engine-room of the "H. T. HARPER," showing diagonal-eccentric valve operating and reversing mechanism; also arrangements of water-cooled exhaust manifolds.

Shaft H. P. of starboard engine on sea trials of the "Harper"	1,195.74 H. P.
Engine-speed	135 R. P. M.
Weight, including flywheel, thrust-block, compressor, pumps, etc	120 tons
Length (including above)	38 ft. 5 in.
Height (from center of crankshaft to top of cylinder-head	15 ft. 3 in.
Overall width	7 ft. 6 in.
Mean indicated-pressure	92 lbs. per sq. in.
Diameter of crankshaft	12 $\frac{3}{16}$ in.
Diameter of crankwebs	7.874 in.
Number of working-cylinders	6
Bore and stroke	20.472 in. by 35.433 in.
Piston-speed	800 ft. per minute
Diameter of piston rod	5.118 in

This engine, while a little longer fore and aft than the Amsterdam production—due to the air-compressor being at the forward end, instead of being operated by rocking-levers off the crosshead or by an auxiliary engine as with one Werkspoor ship—is still very compact and allows of an engine-room of 45 feet, giving ample room to walk around the engine. *This means a great gain of cubic cargo-capacity compared with a steamship of the same size*, especially if we take into account the absence of boiler-water tanks, deep-tanks, and 'tween deck bunkers. But in the "H. S. Harper," 60 ft. has been given over to the machinery as more cargo "space" cannot be used, because she is a tanker.



One of the electric-driven cargo-pumps

The electric control-board

Following the parent design the cylinders are arranged in two large cast-iron boxes or tanks, bolted together, which may be termed a "cylinder-beam," as in addition to holding a big supply of cooling sea-water they afford rigidity to the engine itself. The lower part of the cylinder projects through the underside of the cylinder-beam and has a detachable piece, permitting easy and rapid removal or inspection of the piston and piston-rings. This also is a well-known feature of the parent design, so needs no further description.

Between the cylinder-beam and the cast-iron frames are cast-iron distance-pieces through which the steel columns run, allowing the entire engine from head to base being bolted rigidly together, and so eliminating vibration and weaving, the steel columns running from the upper part of the cylinder-beam down to the bed-plate. Nevertheless, removal of the crank-shaft is an easy matter, as on the rear side of the engine the cast-iron frames are made in two pieces, bolted together, and upon raising the steel columns the lower sections of the cast frames slide out, and the crankshaft can be lifted out. As there is no side strain on this two-piece column casting, it is a practical engineering job.

Between the cylinder-beam and the upper part of the cast-iron frames there is a cast-iron drip-tray running the engine's length for collecting all carbon or dirty oil from the cylinders, and all waste cooling-water, so that nothing can leak on to the bearings or into the crankpit. The piston-rod passes through simple stuffing-boxes in this tray, and which are not exposed to heat of any kind.

The lower halves of the main-bearings are set into saddles in the bed-plate, and the faces of the saddles are scraped until they fit, and the bearing-shells are scraped into the saddles. Adjustments for wear can be made by inserting the shims under the saddle. Single-shin guides have been adopted and are on the operating (front) side of the engine.

As the Werkspoor system of casting the cylinder-head in one piece with the cylinder has given such good results and freedom from cracks, it has been retained, because of the unusual cooling facilities afforded. There is no cylinder jacket in the general sense of the word, the cylinder itself being immersed in the tank of water. It is fitted with a light liner hydraulically pressed into position.

Much engineering interest will be taken in the compressor, as, while this follows the well-known Werkspoor practice of separately operated stages, they are not rocking-lever driven as is usual, but are driven off the forward part of the engine by an extension of the crankshaft. The lowest stage is furthest away from the engine, and each stage has a separate crank. The high-stage has a detachable liner, and the second stage is arranged between the high and low stages without liners. A compressor of similar design was originally adopted with the Werkspoor submarine-engine.

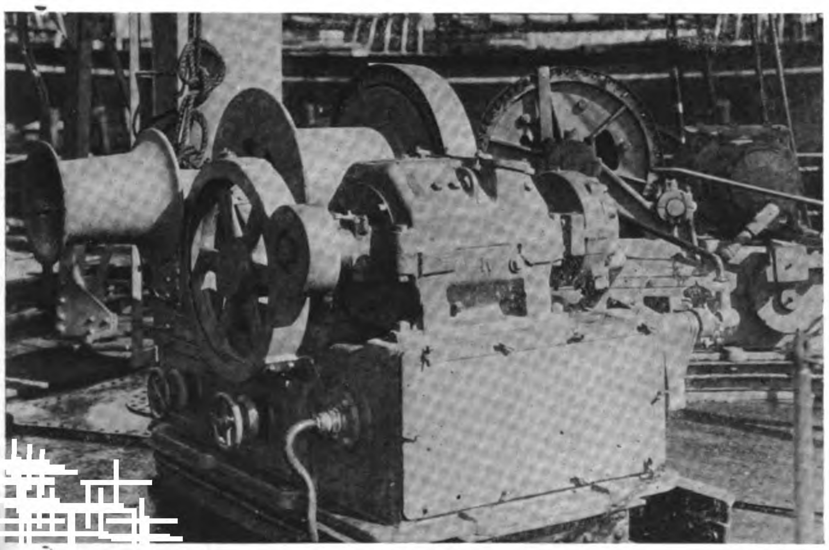
As may be expected, the Pacfic Diesel Co. has adopted the simplified design of Werkspoor reversing mechanism brought-out in 1919, and which at the time was quite a radical change, and considerably speed-up manoeuvring, as well as reducing constructional costs. With the previous Werkspoor design there were two camshafts carrying the ahead and astern cams respectively, and when it was required to reverse the engine, the entire set of shafts and cams were moved forwards and backwards, as the case may be, on sliding brackets, bringing the desired set of cams under the rollers of the valve rockers.

With the device on the "H. T. Harper's" engines referred to there is only one camshaft, and this does not move except to continuously rotate at half engine-speed. In fact, it remains stationary while the reversing operation is performed, and merely serves the purpose of carrying two sets of fixed cams that are rigidly secured on it. Incidentally we may mention that Werkspoor's practice of using cast-iron for the inlet and exhaust cams has been adopted. Years of sea-going experience have demonstrated that this is the best material for the purpose, and the majority of builders of slow-speed Diesel engines have standardized cast-iron for this purpose. The surfaces of the rollers, of course, are chilled.

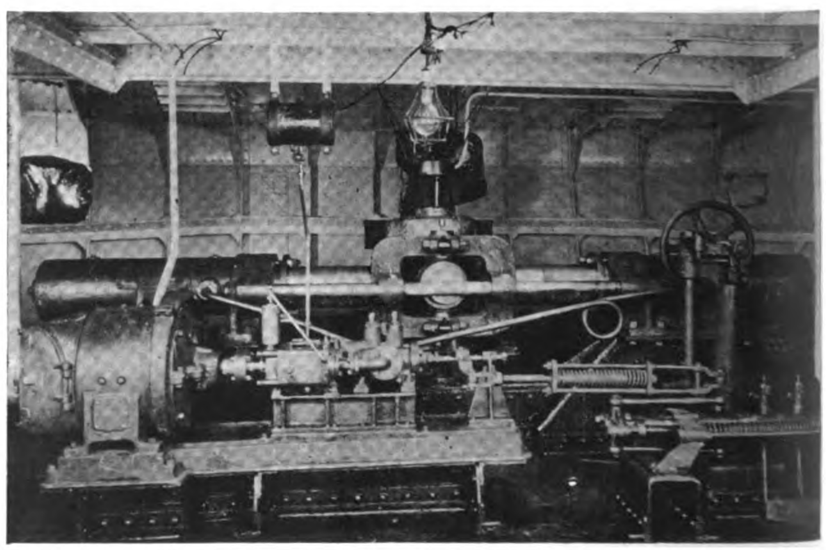
All the reversing motions are carried out by the valve-rockers, and like all eccentric movements the action is very peculiar, yet exceedingly simple. There are four rockers per cylinder, for the inlet, exhaust, air-starting and fuel valves, respectively. Each rocker is mounted on a diagonal-eccentric, the eccentric being secured to the shaft, and is free to move in the hub of the rocker. To shift the rocker-rollers from one cam to another, it is merely necessary to rotate the rocker-shaft 180 degrees, in the neutral position at 90 degrees the rollers are clear of the cams. The turning of this rocker-shaft requires very little effort, and actually can be done by hand. But, to facilitate the operation, a little double-acting air-engine with an oil-cushion is provided, and this reciprocates a ratchet that is in connection to a ratchet-wheel on the rocker-shaft.

When the valve-rocker moves from the ahead-cam to the astern-cam the position of its valve-tappet and also changes, and this is arranged for by the provision of a double head, or tappet, with an adjusting screw on each. The setting of the rocker-rollers is so arranged that when running "ahead" the roller-face is square on the cam, but in the "astern" position the face of the roller is not absolutely square on the cam, it resting at a slight angle, which is of no consequence because the wear of the astern position is exceedingly slight, partly owing to the very limited periods during which the engine runs astern, and partly because of the large size of the roller.

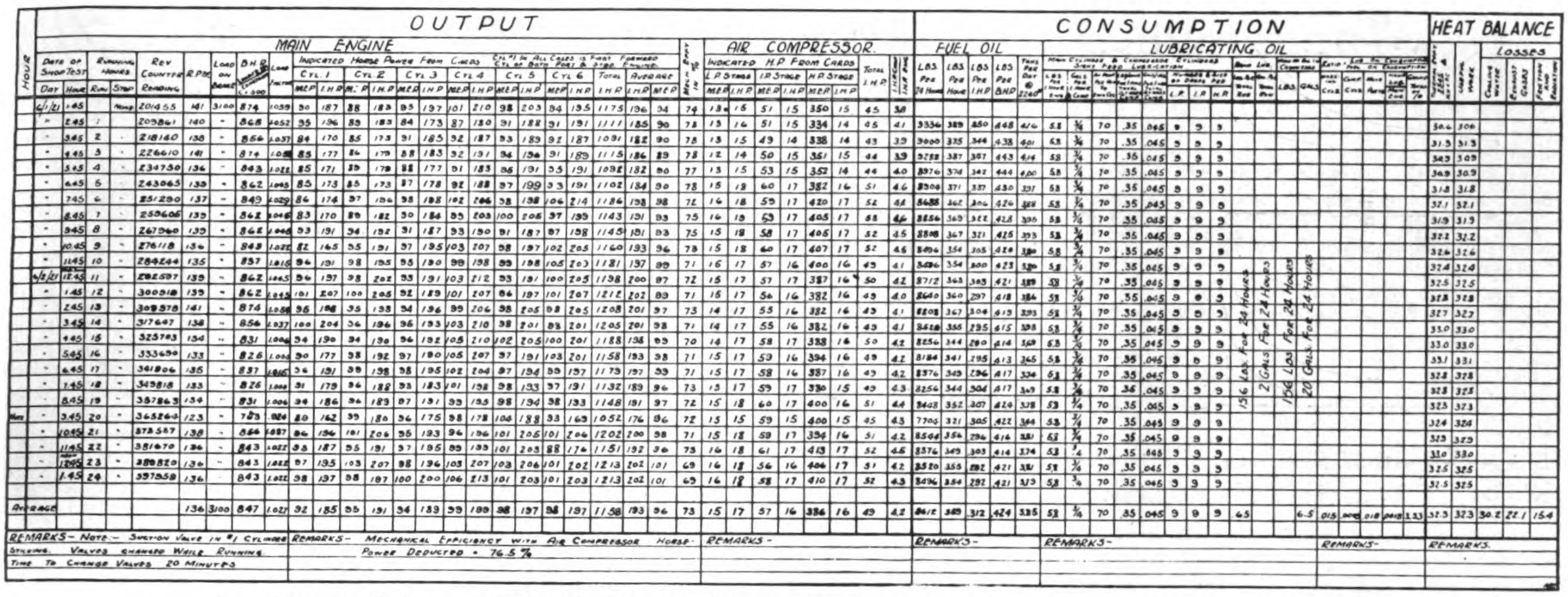
Of course, it would be possible to design the faces of the rollers and cams whereby they would rest quite square on their surfaces in both ahead and astern positions, but this the designers think



One of the Cunningham-G. E. C. electric cargo-winches



The hydro-electric steering-gear of the "H. T. HARPER"



Log of the shop-test of one of the "H. T. Harper's" Diesel-engines. Fourteen degrees Baumé fuel-oil was used

entirely unnecessary, as very satisfactory results are obtained with the way they now are arranged. To operate the camshaft the old system of long hollow rods and cranks which pull and not push has been retained, no trouble ever having occurred from this source with any engine, also the movement is unusually silent and free from vibration. The rods are sawn down through the centre, opened-out and held apart and strengthened by struts.

The three principal auxiliary Diesel-engines are of Dow construction, two being of 200 b.h.p. in four-cylinders at 250 r.p.m. each, coupled to a 150 k.w. compound-wound 240-250 G.E.P. electric-generator. The third is of 150 b.h.p. in three-cylinders and coupled to a 100 k.w. generator. The bore and stroke of these Diesel-engines is 12 in. by 18 in. respectively, and they are of the four-cycle type. In addition, there is a 16 b.h.p. Pacific Diesel-engine of new design driving a 10 k.w. auxiliary generating-set at 360 r.p.m.

Power for the following auxiliary machinery is provided by the above three Dow-Diesel G.E.C. generating-sets, namely:

AUXILIARIES IN ENGINE ROOM

2. Circulating-water pumps for main and auxiliary engines, centrifugal type, 5 in. suction, 4 in. discharge, direct connected to General Electric motor of 15 H. P. Pumps manufactured by Alberger Pump and Condenser Company, New York.
1. Fire and bilge-pump, 3-stage Alberger pump, 4 in. suction, 3 in. discharge, direct-connected to General Electric motor of 40 H. P.
1. Bilge-pump duplex horizontal-plunger type, 4 in. suction, 3 in. discharge geared to General Electric motor of 7½ H. P. 850 R. P. M. Set manufactured by the Worthington Pump and Machinery Corporation, Deane Works, Holyoke, Mass.
1. Sanitary-pump, 2-stage, Alberger centrifugal pump, 3 in. suction, 2½in. discharge, direct-connected to General Electric motor of 7½ H. P.
2. Lubricating-oil pumps, 6 x 4, suction, 4 in. discharge, 4 in. geared to General Electric Motor, 7½ H. P. Manufactured by Kinney Mfg. Company, Boston, Mass.
1. Fresh-water pump, centrifugal, 1½ in. suction, 1½ in. discharge, direct-connected to General Electric Motor 5 H. P., 1,700 R. P. M. manufactured by Krough Manufacturing Co., San Francisco, California.
1. Fuel-oil service-pump, 2½ in. suction, 2½ in. discharge, geared to 2 H. P. General Electric Motor. Manufactured by Kinney Mfg. Company, Boston, Mass.
1. Auxiliary compressor, duplex-tandem type, size 9 x 4 x 6, 350 lbs. air pressure, geared to General Electric Motor, 50 H. P., 1,075 R. P. M., 230 volts, 18.3 amperes. Manufac- by Rix Compressed Air and Drill Company, Los Angeles, California.
1. Air-booster compressor, Rix type, size 1⅛ x 4½, 1,000 lbs. air pressure direct connected to General Electric Motor 5 H. P., 1,700 R. P. M., 19 amperes 230 volts.
1. Fan for ventilating rooms, Sturtevant No. 3 multivane, direct-connected to Sturtevant Electric Motor 2 H. P. type 2-B. Manufactured by B. F. Sturtevant Company, Hyde Park, Boston, Mass.
1. Donkey-boiler, vertical 72 in. dia, 10 ft. 7 in. long, fitted to burn oil with Ray type fuel-oil burning equipment. Contains 203, 2½ tubes 48 in. long, with total heating surface of 600 sq. ft. Built by Moore Shipbuilding Company, Oakland, California.
1. Donkey-boiler feed pump, Worthington duplex-horizontal, size 6 x 4 x 6.
1. Balancer, General Electric D./C. 220/125 volts, 24 amperes, 1,700 R. P. M. type 26A. 1 Balancer set 4¾ K. W., 2,000 R. P. M. 250/125 volts, amperes 38.
1. Air-starting bottle for each auxiliary engine, 1,000 lbs. pressure supplied by Dow Pump and Diesel Engine Company, Alameda, California.
3. Air-reserve bottles, 16 in. dia. x 23 ft. long, 1,000 lbs. pressure per main auxiliary engine.
6. Air tanks, 4 ft. dia., 19 ft. 9 in. long, 300 lbs. air pressure.
2. Daily service fuel-oil tanks, 4 ft. 6 in. dia, 13 ft. long, total capacity about 2,900 gals.
1. Kerosene tank, 4 ft. 6 in. dia.
1. Whistle air-tank, 2 ft. 6 in. dia., 6 ft. long. 150 lbs. air pressure.

DECK AUXILIARIES

1. Windlass, horizontal type direct-connected to 35 H. P. General Electric Motor, 500 R. P. M., 230 volts, suitable for 2 in. chain. Manufactured by Allan Cunningham Co., Seattle, Washington.
6. Winches, horizontal type, single drum double geared, direct-connected to General Electric Motor of 15 H. P., 230 volts, 600 R. P. M. Manufactured by Allan Cunningham Company.
1. Steering-engine, hydro-electric type fitted with hydraulic telemotor control, size of plungers 9 in. dia., Pump motor, General Electric of 12 H. P. 600 R. P. M., 230 volts. Manufactured by Hyde Windlass Co., Bath, Maine.
3. Capstans, vertical type 11½ in. dia., direct-connected to General Electric Motor of 10 H. P. Manufactured by Allan Cunningham Company.
1. Refrigerator-machine, 1½ tons capacity, of the Ethyl chloride type. Manufactured by the Clothel Company, New York.

AUXILIARIES IN PUMP-ROOM

3. Cargo-oil pumps, Kinney 10 in. suction, 10 in. discharge, size 5. D 14 x 9, geared to General Electric Motor 90 H. P. 300 R. P. M. of pump.
1. Bilge and Ballast pump, duplex horizontal, size 7 x 6 Worthington type, 6 in. suction, 5 in. discharge, geared to General Electric Company's Motor 10 H. P.
1. Fuel-oil transfer-pump, Kinney 4 in. suction, 4 in. discharge, size S. D. 8 x 4, geared to General Electric Motor 20 H. P., 400 R. P. M. of pump.
1. Forward oil and ballast pump, Kinney 4 in. suction, 4 in. discharge, size S. D. 8 x 4, geared to General Electric Motor 20 H. P.
1. Hand Pump, 2½ in. Hooker type installed in Controller Room.
1. Ventilating fan, multivane Sturtevant type, direct-connected to 5 H. P. Sturtevant electric-motor.

TRIAL TRIP OF MOTORSHIP "H. T. HARPER"

San Francisco Bay and Vicinity of S. F. Light Ship, Farallone Islands, October 27, 1921

Vessel left the Moore Shipbuilding Company's yard at 7 A. M. and proceeded to San Francisco Bay for purposes of completing the ballasting of the vessel to the required draft and adjusting compasses, preparatory to the trial trip. The ballasting and adjustment of compasses was completed at about 10:30 A. M., while the vessel was cruising in the bay.

At about 11 A. M. the vessel was then headed full-speed ahead outside the Golden Gate toward S. F. Light Ship and Farallone Islands for the endurance run and for establishing the speed of the vessel, on the run between these two points. The first run (outward run) commenced at 11:55, at which time the S. F. Light Ship had been sighted and the vessel returned back to the yard at about 5:30 P. M. While at the trial trip the auxiliaries were tested out and found in good working condition, and the trial trip as a whole has been declared to be successful and satisfactory to the owners. A large number of prominent shipping men from San Francisco attended the trial trip.

Detailed results of the trial trip are tabulated, and the results of test of speed of the vessel on the measured distance between S. F. Light Ship and the Farallone Islands are as follows, the distance being 16.5 nautical miles.

1st Run S. F. Light Ship to Farralones:

Time	1 hr. 26 min.
Speed	11.5 knots
Total revolutions, port engine	11,008
Total revolutions, starboard engine	11,094
Average revolutions, port engine	128 R. P. M.
Average revolutions, starboard engine	129 R. P. M.
Slip of propeller, port engine	9 7%
Slip of propeller, starboard engine	10.5%
I. H. P., port engine	1,318 H. P.
I. H. P., starboard engine	1,577 H. P.
Total I. H. P., both engines	2,895 H. P.

2nd Run Farralones to S. F. Light Ship·

Time	1 hr. 20 min.
Speed	12.1 knots
Total revolutions, port engine	11,120
Total revolutions, starboard engine	11,040
Average R. P. M , port engine	139 R. P. M.
Average R. P. M., starboard engine	138 R. P. M.
Slip of propeller, port engine	10.84%
Slip of propeller, starboard engine	10%
I. H. P., port engine	1,430 H. P.
I. H. P., starboard engine	1,685 H. P.
Total I. H. P., both engines	3,115 H. P.

Run: Between S. F. Light Ship and the Farralone Islands.
Draft: Forward 20 ft. 6 in., aft 21 ft., mean 21 ft. 3 in.

AVERAGE DATA

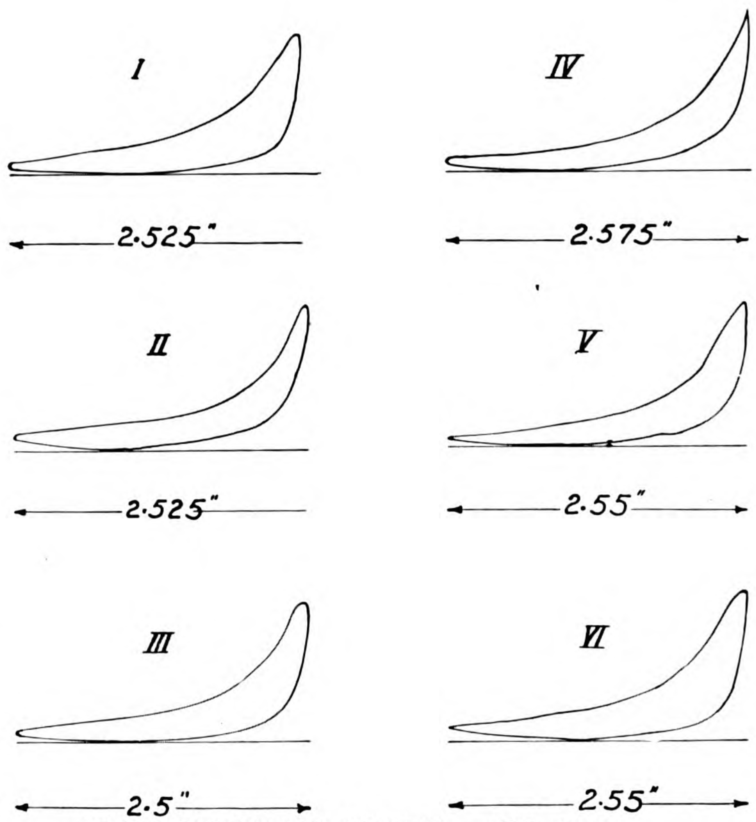
Speed of vessel	11.8 knot.
Time on run	1 hr. 23 min.
Revolution of port engine	134 R. P. M.
Revolution of starboard engine	134 R. P. M.
Slip of propeller, port engine	10.27%
Slip of propeller, starboard engine	10.25%
I. H. P., port engine	1,380 H. P
I. H. P., starboard engine	1,638 H. P.
Total	3,018 H. P.
Brake H. P., port engine at 73%	1,007.4 H. P.
Brake H. P., starboard engine at 73%	1,195.74 H. P.
Total	2,203.14 H. P.
Port generator, volts	230
Port generator, amperes	210
Starboard generator, volts	230
Starboard generator, amperes	300
Pressure, main air tanks	300 lbs.
Pressure, air bottles	750 lbs.
Pressure, whistle tank	125 lbs.
Pressure, starting main port engine	300 lbs.
Pressure, low main port engine	15 lbs.
Pressure, intermediate port engine	162 lbs.
Pressure, injection	900 lbs.
Pressure, starting starboard engine	300 lbs.
Pressure, low	17 lbs.
Pressure, intermediate	182 lbs.
Pressure, injection	925 lbs.
Temperature exhaust main port engine	464°
Temperature exhaust main starboard engine	520°
Pressure, injection aux. engine port	630 lbs.
Pressure, intermediate engine port	40 lbs.
Pressure, injection aux. engine starboard	750 lbs.
Pressure, intermediate engine starboard	53 lbs.
Fuel oil consumption, main engines, per hour according to meter reading	129 gal.
Fuel oil consumption of aux. engines, per hour according to meter reading	15.3 gal.
Fuel oil consumption for main and aux. engines per hour, according to soundings	127.8 gal.
Fuel oil consumption per B. H. P. hr	.45 lbs.
Temperature refrigerator room	39°
Temperature meat room	32°

The vessel returned to Moore's shipyard at 5.30 in the afternoon, in order to have some electrical work completed. The engines operated absolutely perfect during the whole trial-trip and the owner's representatives on board as well as everybody who attended were highly pleased with the performance of the engines.

Her Maiden Voyage

The "H. T. Harper" started on her maiden voyage, leaving Richmond on November 4th at 4.30 P. M., loaded with petroleum products for the Puget Sound, and arriving at Point Wells on November 7th at 4.35 P. M., covering a distance of 785 miles. Her average speed was 10.90 knots; maximum speed 11.4 knots.

She left Point Wells on November 10th at 11.02

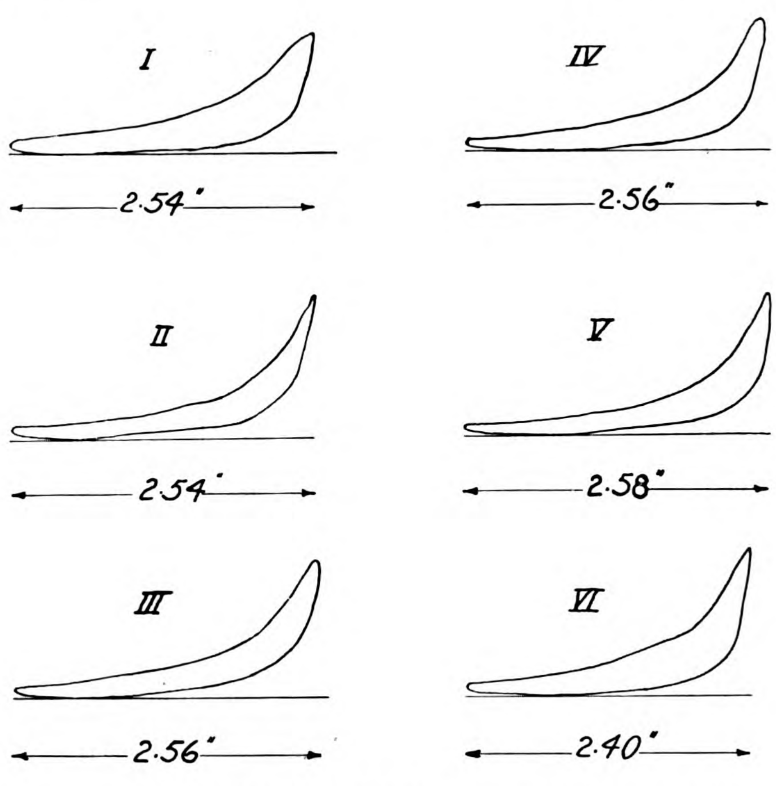


MAIN STARBOARD ENGINE - 138 R.P.M.

M.E.P.	
I =	154.45 lbs.
II =	116.83 "
III =	138.00 "
IV =	120.40 "
V =	127.45 "
VI =	152.90 "
Total =	810.03 lbs.
Average per cyl. =	135 "

I.H.P.	
I =	293
II =	222
III =	262
IV =	228
V =	242
VI =	290
Total =	1537
Average per Cyl. =	256.16

TRIALS OF M.S. "H.T. HARPER."



MAIN STARBOARD ENGINE - 134 R.P.M.

M.E.P.	
I =	133.85 lbs.
II =	98.50 "
III =	109.35 "
IV =	123.10 "
V =	94.75 "
VI =	135.40 "
Total =	694.95 lbs.
Average per cyl. =	115.83 "

I.H.P.	
I =	268
II =	188
III =	244
IV =	218
V =	196
VI =	266
Total =	1380
Average per Cyl.	230

TRIALS OF M.S. "H.T. HARPER."

Indicator-cards taken on sea-trial.

A. M., arrived at Point Richmond November 13th at 6.05 A. M., covering a distance of 785 miles. Average speed 11.71 knots, although the average speed for the first 725 miles was 12.10 knots when a heavy fog was encountered and the engines had to be slowed down; maximum speed on return trip 12.8 knots.

Indicator-cards taken on the outgoing trip to Point Wells, loaded, were as follows:

Nov. 5, 1921, 10:00 a. m.—

Port	132 R.P.M.	1,102 I.H.P.	804 Shaft H.P.
Starboard	135 R.P.M.	1,253 I.H.P.	915 Shaft H.P.

Nov. 6, 1921, 9.00 a. m.—

Port	134 R.P.M.	1,168 I.H.P.	855 Shaft H.P.
Starboard	134 R.P.M.	1,194 I.H.P.	870 Shaft H.P.

Nov. 7, 1921, 3.00 p. m.—

Port	138 R.P.M.	1,225 I.H.P.	894 Shaft H.P.
Starboard	139 R.P.M.	1,285 I.H.P.	938 Shaft H.P.

Indicator cards taken on the return trip show as follows:

Nov. 11, 1921, 11.00 a. m.—

Port	135.8 R.P.M.	1,222 I.H.P.	892 Shaft H.P.
Starboard	136.5 R.P.M.	1,362 I.H.P.	994 Shaft H.P.

Nov. 12, 1921, 9 00 a. m.—

Port	133.9 R.P.M.	1,132 I.H.P.	826 Shaft H.P.
Starboard	135.6 R.P.M.	1,216 I.H.P.	888 Shaft H.P.

Average pitch of 3-bladed port propeller..............9 ft., 11 in.
Average pitch of 3-bladed starboard propeller..............10 ft.
This gives an average speed of 11.305 knots for the round voyage of 1570 nautical miles.

The engines performed absolutely perfect both during the outgoing and the home-coming trips. There was not the slightest adjustment to be made on the engines upon arrival at Point Richmond, and as soon as the vessel made fast, the engineers left the engine-room and the ship was immediately loaded, remaining at Point Richmond only twenty-four hours and proceeded with a full cargo for San Pedro, California.

The successful performance of this vessel and her machinery no doubt is gratifying to all concerned with her construction, including her owners and the engineering companies in Holland and England, under whose licenses the main and auxiliary Diesel engines were built, and will do much to convince shipowners that this class of machinery can be built in this country.

TWO NEW DIESEL-YACHTS AND TWO CONVERSIONS ORDERED

A big Diesel-engined steel yacht 178 ft. long, 24 ft. breadth, and 13 ft, 6 in. depth has just been ordered from the designs of Cox & Stevens, of New York, who are also superintending the construction of this craft at the yard of the Newport News Shipbuilding and Dry Dock Co. Two 550 h.p. Winton Diesel-engines are to be installed. Ten years ago such a yacht would likely have been steam-driven, five years ago gasoline-driven. We are progressing.

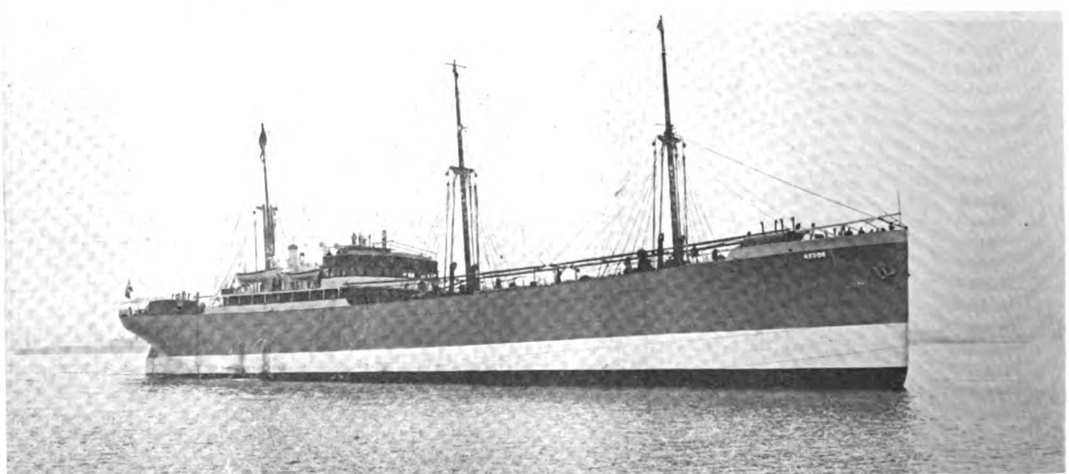
Another large pleasure-boat to be powered with Diesel-engines is under construction at the yard of Kyle & Purdy, City Island, New York, under the superintendence of Henry J. Gielow, who designed this 101 ft. motor-houseboat for Louis H. Eisenlohr. Two 120 h.p. Neseco Diesel-engines will afford Mr. Eisenlohr long and economical cruises.

The three-masted schooner yacht "Alcyone" is now being converted from steam to Diesel-electric drive at the yard of the Tebo Yacht Basin Co., Brooklyn to whom the contract was awarded on October 19th. The "Alcyone" is very similar to the "Guinevere" which was illustrated in our November issue. Two 300 h.p. Winton Diesel-engines, Westinghouse electric-generators and motor, a new steel deck house and other equipment are being installed under the supervision of Tams, Lemoine & Crane, naval architects of New York.

Further progressive work is being done in the conversion from gasoline-drive to Diesel-drive of the 140 ft. yacht "Saballo" at the yard of Robert Jacob, City Island. Two 300 h.p. Winton Diesel-engines are being installed under the supervision of Tams, Lemoine & Crane.

ROTTERDAM LLOYD'S LINE MOTORSHIP

Sea trials of the new motorship "Kedoe" of the Rotterdam Lloyd Line were run on the 10th of November and a speed of 12.4 knots was averaged at 142 R.P.M. The vessel has a displacement of 3440 tons. The fuel consumption including auxiliaries was 139 grams per I.H.P. hour.



Rotterdam-Lloyd's new Burmeister & Wain-engined motorship "Kedoe" which ran trials on November 10th

Launch of American Motorship "Californian"

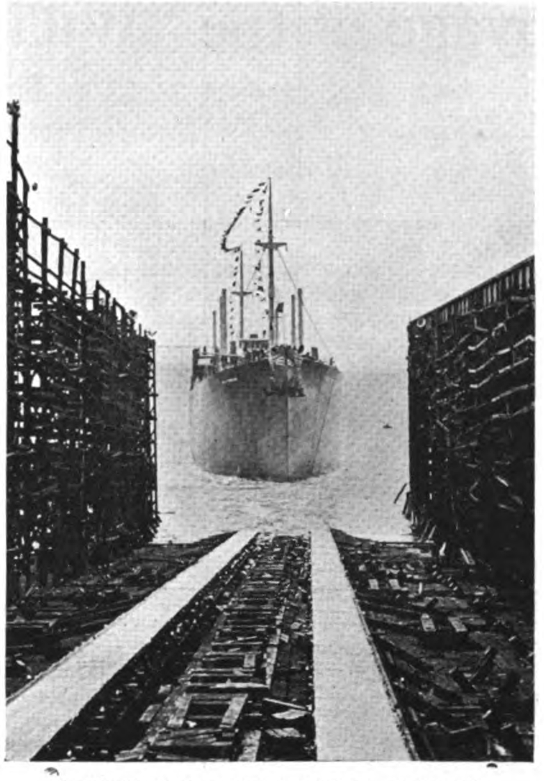
First of American-Hawaiian Steamship Co.'s Two New Diesel-Driven Freighters Takes the Water—Sister Vessel "Missourian" to Be Launched Dec. 14th

"CALIFORNIAN," the first twin-screw motorship originally designed and completely constructed on the Delaware River, was launched November 14th at the yards of the Merchant Shipbuilding Corporation, Chester, Pa. The "Missourian," a sister-ship, will be launched this month. The launching of these motorships marks the advent of the Merchant Shipbuilding Corporation into the field of large full-powered Diesel-engined freighters, and the placing of this corporation in the foremost rank of progressive shipbuilders who have recognized the growing importance of ships of this modern type. The only American-built ship comparable in size with the "Californian" and "Missourian" is the "William Penn," whose engines were built in Denmark, and installed in a hull originally intended for geared turbines, but the "Californian" is an all-American product throughout.

For long and economical voyages the motorship is rapidly gaining in prestige because of the many points in its construction which make for economical operation, and judging from the numerous inquiries which have been received by the Corporation in reference to the "Californian" and "Missourian" it is apparent that widespread interest has developed, not only among ship-operators but among the prominent shipbuilders of the country.

The initial cost of equipping this type of motorship with internal-combustion engines did not deter the directors of the American-Hawaiian Steamship Company—who are operating under the United American Lines—from appropriating funds for the additional investment, because they were assured by the officers and technical staffs of the owners and builders that the efficiency and economy effected would finally justify the expenditure. Furthermore, this publication did much to influence the directors' decision in this respect, by means of many personal calls and by means of useful data in our editorial pages.

It is believed by advocates of the motorship, says the Merchant Shipbuilding Corporation, that it would be a progressive step in the upbuilding of the American Merchant Marine to convert at least fifty-per-cent. of our existing freighters and passengers-freighters, which are tied-up, to Diesel or Diesel electric power, and it is reported that the Shipping Board already contemplate the conversion of several units of its aggregate tonnage to that type.



Launch of the new American motorship "Californian"

The "Californian" and "Missourian" are considered the most acceptable type of motorship for the establishment and maintenance of long distance voyages for both cargo and passenger carrying trade or for combined cargo-passenger routes. Both are equipped with the most modern, efficient and economical machinery and commercial appliances known today. Their size and tonnage are the outstanding features for economical service.

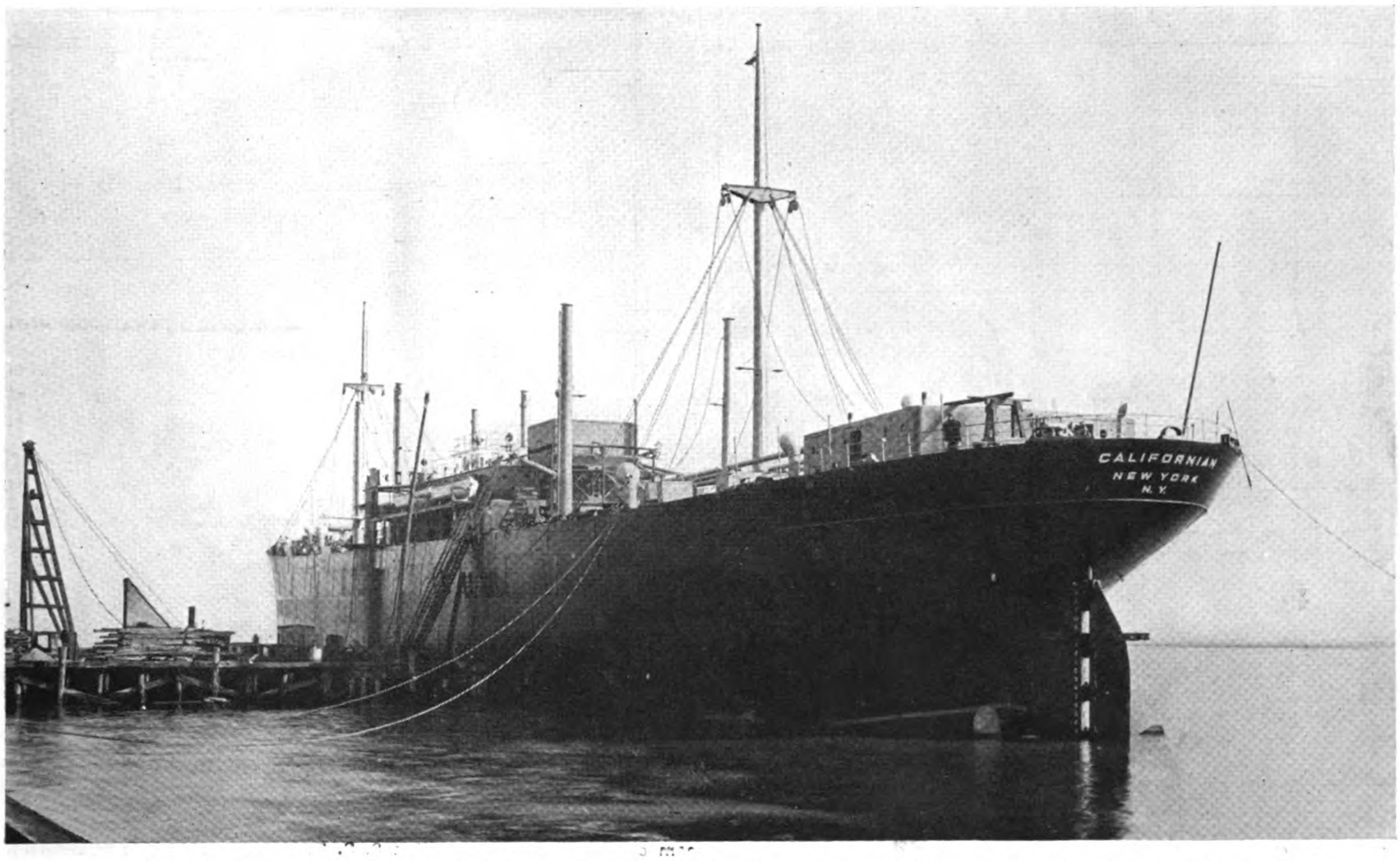
Their principal dimensions are as follows:

Length overall	461 ft.
Length between perpendiculars	445 ft.
Beam, molded	59 ft., 8 in.
Depth, molded to shelter deck	39 ft.
Contract draught	28 ft., 6 in.
Displacement at contract draft	16,500 tons
Deadweight at contract draft	11,000 tons
Cargo capacity, incl. deep tank, bales	560,000 cu. ft.
Contract speed	11.5 knots
Normal fuel capacity	1,400 tons
Reserve fuel capacity in deep tank	760 tons
Normal radius	25,000 miles

Drawings have already been published in "Motorship". In order to conserve length, the quarter amidships in these vessels are two decks high and relatively short, giving a maximum length for hatches and cargo-handling gear. They are rigged with two masts and six king-posts, carrying twenty-one booms, one of 30 tons capacity, one of 10 tons, 11 of 5 tons, and 8 of 3 tons. These serve seven hatches, all 18 feet wide and of varying lengths, the longest being 35 feet. All masts, posts and booms are of steel, the masts being of steel right up to the trucks, eliminating the usual wooden plug top masts.

Cargo-handling machinery for these ships has been most carefully selected, and consists of fourteen double-geared winches, and two Shepard Crane & Hoist Company's winches on each ship, the fourteen winches for the "Californian" were manufactured by the American Engineering Company and the winches for the "Missourian" were made by the Maine Electric Company. Each winch is driven by a thirty H.P. electric motor of the "Mill Type." The motors and the controllers for the "Californian" were supplied by the Westinghouse Manufacturing and Electric Company. Those for the "Missourian" were furnished by the General Electric Company.

The propelling machinery consists of the Cramp-B. & W. Diesel-engines illustrated elsewhere in this issue. Thrust bearings are of the horse-shoe



American-Hawaiian Co.'s motorship "Californian" at the do ck after the launch at the Merchants Shipyard, Chester, Pa.

type, and the 14 foot diameter propellers are of manganese-bronze.

Electricity for engine-room auxiliaries, deck machinery, etc., is generated by four 65 K.W.D.A. 230-volts generators each direct connected to a two-cylinder four-cycle Diesel engine. At sea, only one set will be required, and in port a maximum of three, so that there always will be a "stand-by" set.

All deck-machinery, including windlass and steering gear and all engine-room auxiliaries, except one small auxiliary steam driven air compressor for charging air-bottles, are electrically operated. The steering gear is electric hydraulic drive. There is one 120 H. P. electrically driven two-stage auxiliary air-compressor. A donkey-boiler 48 in. dia. x 108 in total height is installed to generate steam for heating purposes and for fire-extinguisher service. The Rich fire-detecting and extinguishing system is also fitted, in conjunction with steam and CO_2, the latter being carried in flasks located on deck.

No effort has been spared in these vessels in obtaining only the best in workmanship and material, and in the selection of auxiliaries, so that, when they go into service, it is expected that they will rank with the best freighters in the world in economy and reliability. They will stand as a "living" denial to the assumption that America cannot build big Diesel-driven ships.

Maiden Voyage of the "William Penn"

Excellent Performance Put-Up by the Shipping Board's Diesel-Driven Motorship

As we anticipated the only motorship owned by the U. S. Shipping Board has put up a convincing argument in favor of the Diesel-drive by the result of the first half-stage of her maiden voyage around the world. And, she has made a showing against which the turbine-electric ship "Eclipse" can make no near comparison in speed, economy of operation, or cargo-capacity on a similar test trip.

Regardless of the very heavy weather encountered, which caused her captain to heave-to for five hours and "crawl-along" for another ten hours to save the deck-cargo during a hard gale following one of the well-known China Sea typhoons, the "William Penn" averaged better than 11 knots from New York to Yokohama on a daily consumption of 13 tons of oil with a full load of cargo aboard.

Compared with any class of steamship this is an almost unbelievable performance; but, while well up to the average of Diesel-driven vessels, it is by no means unusual, as it is now more or less a regular practice with modern motorships to put up performances of this nature.

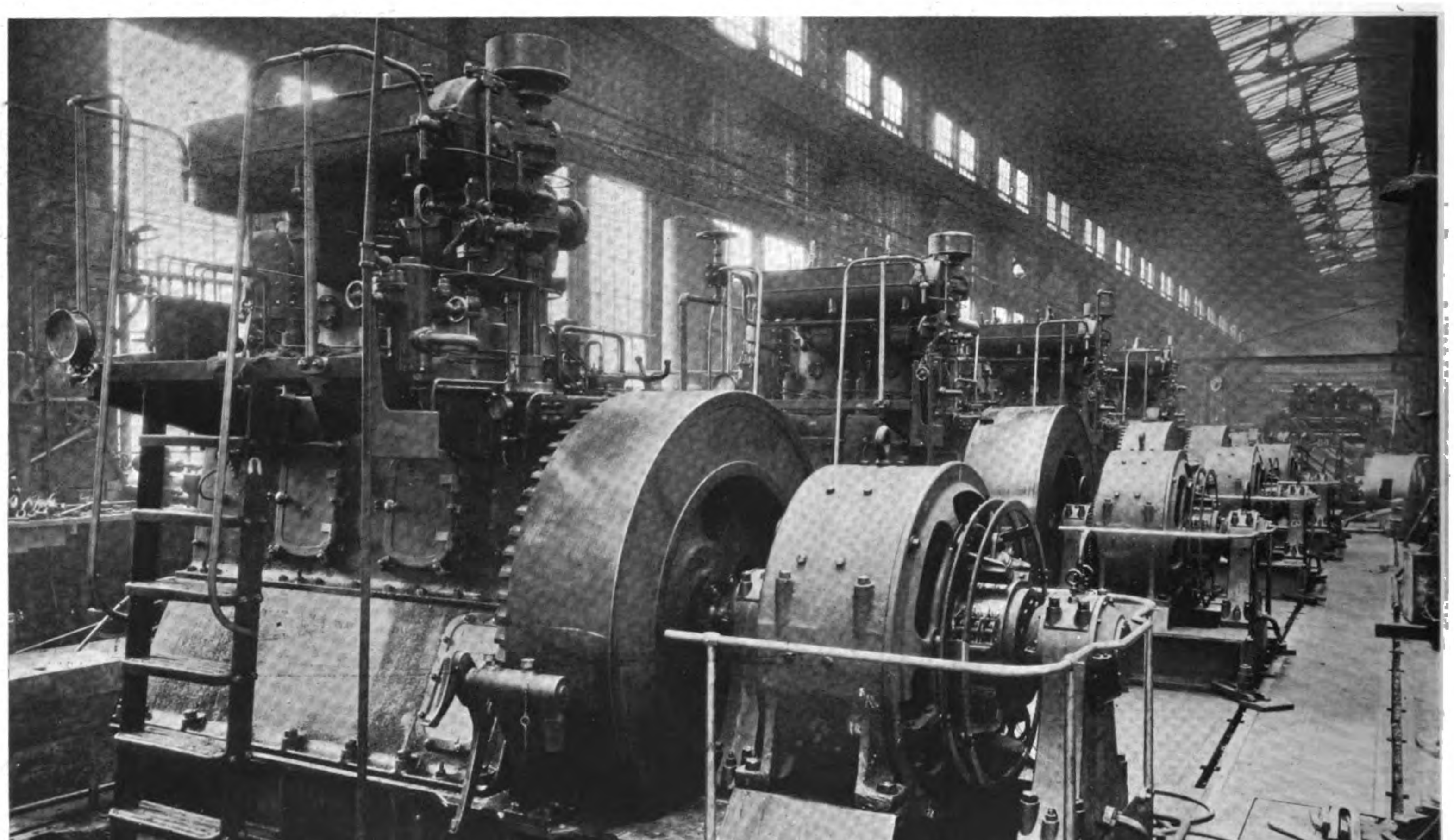
It will be remembered that the "William Penn" has a capacity of about 11,725 tons cargo besides the fuel, stores, and water, when on her fully-loaded displacement of 17,100 tons. On this trip she had on board approximately 11,000 tons of cargo, of which included 500 bbls. of rosin put on deck at Savannah, and much bulky cotton below decks, in addition to some deck-cargo put aboard at New York. She took on some fuel at Philadelphia, some at the Panama Canal and the balance at Honolulu—the total being more than sufficient to take her entirely around the world. She has a crew of 42 men, or several less than would be required on a steamer of the same size. Captain Wright told newspaper men at Yokohama that the operation of this vessel has been 100% and he is delighted with her. In every port at which they called the "William Penn" was the object of interest and admiration. She has an all-American crew with the exception of Chinese in the steward's compartment. Full details of this ship and illustrations were published in "Motorship" for October, 1921, and in previous issues.

Diesel-Engine Construction at the Cramp Shipyard

Visit to This Philadelphia Plant Where Four 2,250 h.p. B. & W. Engines Are Nearing Completion for the American Hawaiian Co.'s Motorships "Californian" and "Missourian"

MANY domestic shipping men seem to have been under the impression that Diesel-engines of large power cannot be properly constructed in this country because of the difficulties of workmanship, lack of facilities, and non-availability of suitable materials. Various public statements to this effect have also been made by men wholly unfamiliar with the true position and who, undoubtedly, have never seen the inside of some of the great American Diesel Engine factories. Some of the marine journals also, either through carelessness or ignorance, frequently let such view-points appear in editorial articles that they publish. Evidence given before congressional committees by prominent naval architects also display similar lack of knowledge on the splendid Diesel-engine building plants that this country has, several of which have been illustrated heretofore in our pages.

It is therefore distinctly encouraging to learn that a number of American shipowners have recently visited the shipyard and engine plant at



Four of the Cramp-B. & W.-Diehl electric-generating sets for the engine-room of the American-Hawaiian S. S. Co.'s two motorships "Californian" and "Missourian" in the erecting shop at the De La Vergne Plant, New York

Philadelphia of the Wm. Cramp & Sons Ship & Engine Building Company, and that they have been agreeably surprised to see such excellent progress being made with the four 2,250 i.h.p. main engines and auxiliary machinery of Burmeister and Wain design for the two 12,000-ton motorships "Californian" and "Missourian" of the United American Lines. The first of these vessels was launched on the 14th of November at the Merchants Shipyard, Chester, Pa., and is to be towed to the works of the Cramp Company for the installation of the machinery.

to the plant in order to keep fully posted as to the progress of the work. The accompanying illustrations portray the extent of construction up to the middle of last month. They also show the builder's facilities and should dispel any doubt as to their ability for carrying out this class of work. The facilities and the standard of workmanship are equal to the best leading European Diesel factories where Diesel Engines have been building for ten times as long a period.

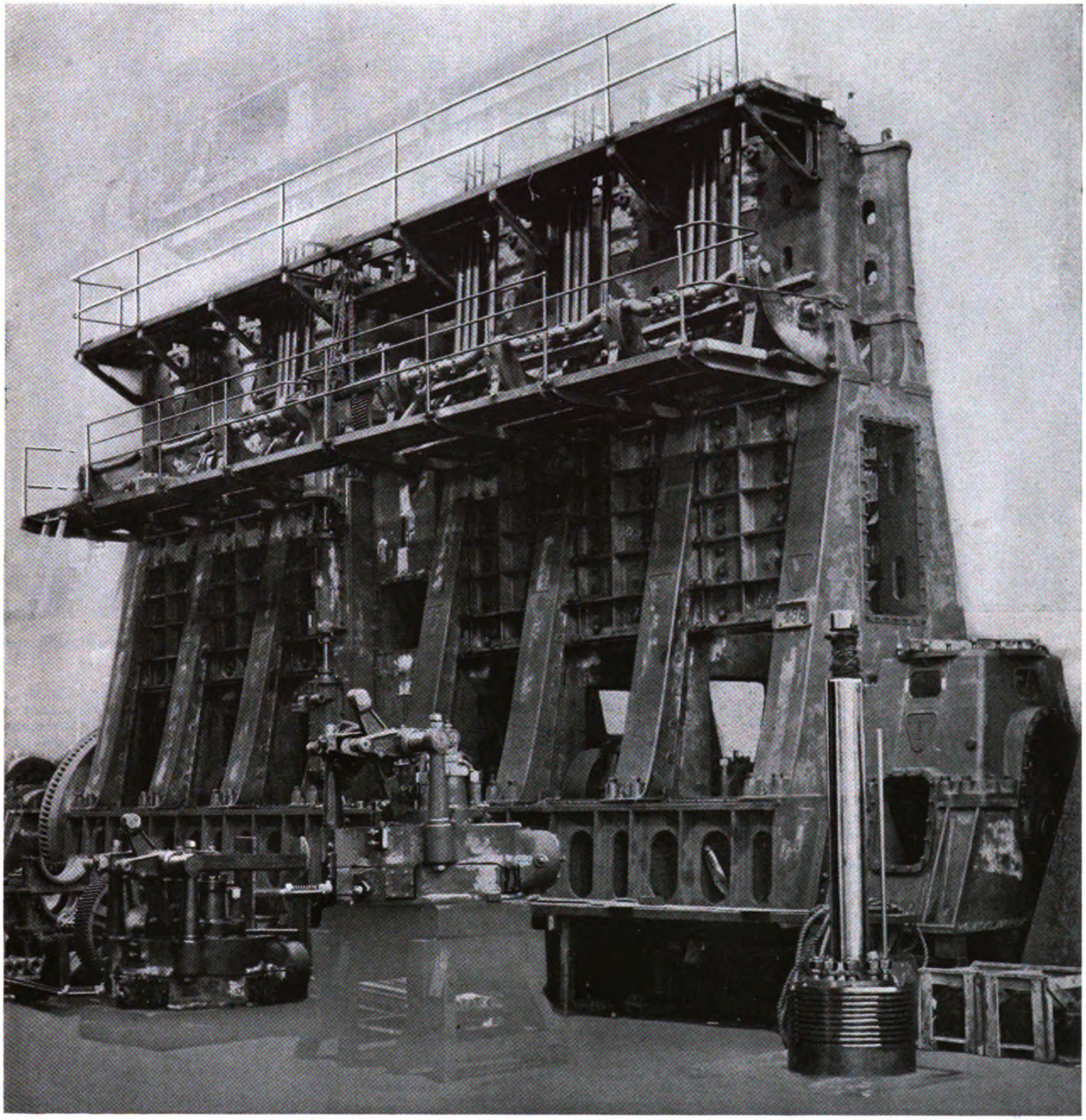
As to materials for the construction of Diesel-engines, Cramps, and other domestic concerns, are considerably better off in the choice of suitable pig-iron for making the special cast-iron mixtures required than are the European builders. Consequently, there is no foundation for the mistaken idea that large sized Diesel-engines for the Merchant Marine cannot be satisfactorily constructed in the United States.

Due to the large number of engines built on the continent of this particular size by Burmeister and Wain and other licensees, and the great care being exercised in their manufacture, the Cramp engineers do not consider it necessary to test the main engines in the shops. After assembling and turning-over, they will be taken down and re-erected in the ships.

The four auxiliary Diesel-engines for the first vessel are shown in one of the illustrations on the test floor, and have been tested and are ready for installation.

The Cramp Company have plans for extending their facilities for the construction of Diesel-engines should the demand justify it. A large part of the shops used during the war for building the highest class of naval machinery is now converted over to the Diesel work.

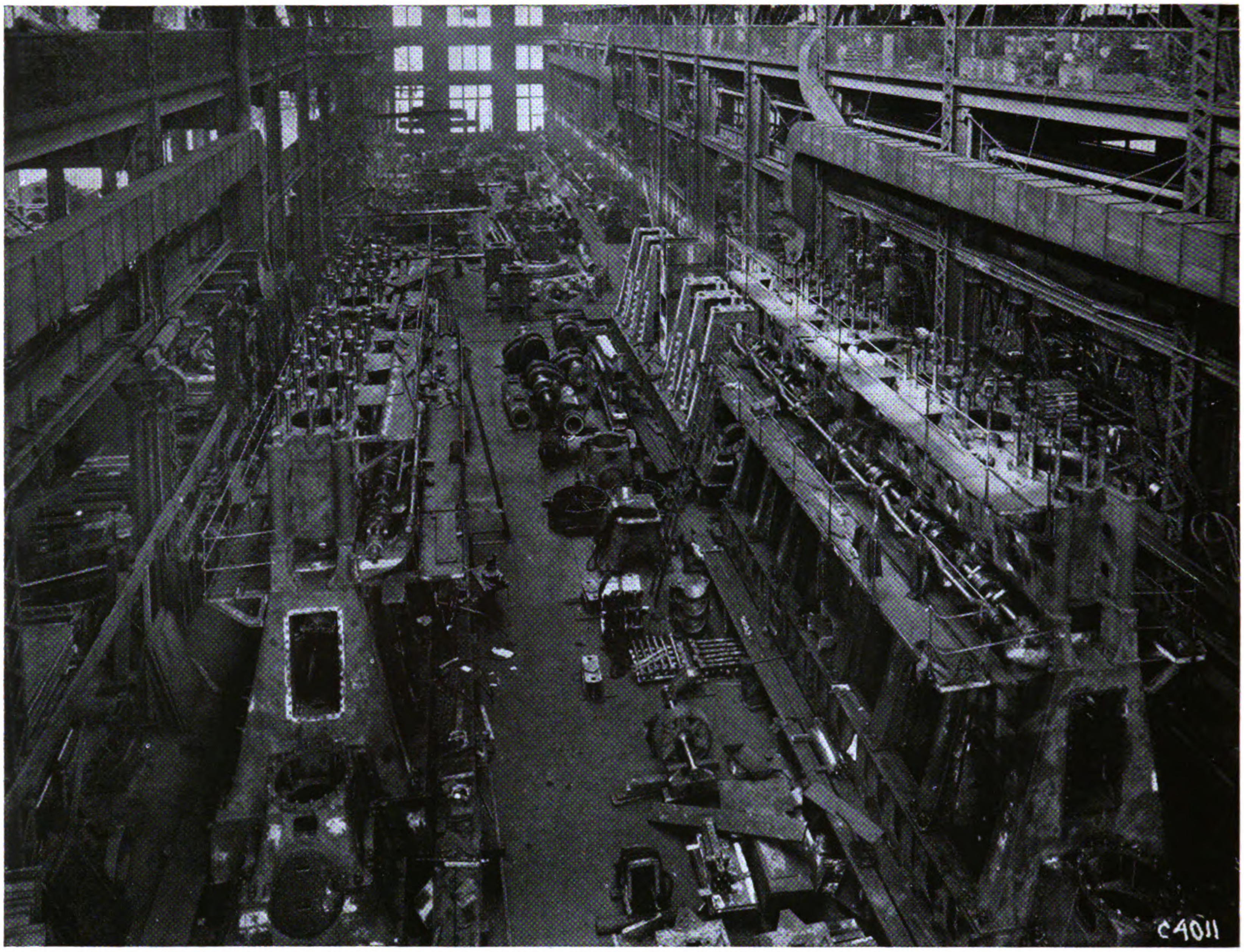
The main erecting shop is 332 feet long by 142 feet wide. A bay of the adjoining hydraulic shop is given over to the erection of such auxiliary ma-



One of the 2,250 i.h.p. Cramp B.& W. Diesel marine-engines showing recent stage of construction. Since the photograph was taken the cylinder-heads have been placed in position. In the foreground two cylinder-heads and one of the pistons can be seen

In recent months domestic shipowners have been displaying more interest in the Diesel Engine, due no doubt to the world-wide economic pressure, they seeing in the oil engine an outlet for relief from the high operating costs of deep sea merchant vessels.

During the course of the erection of these engines at Cramps we have made a number of visits



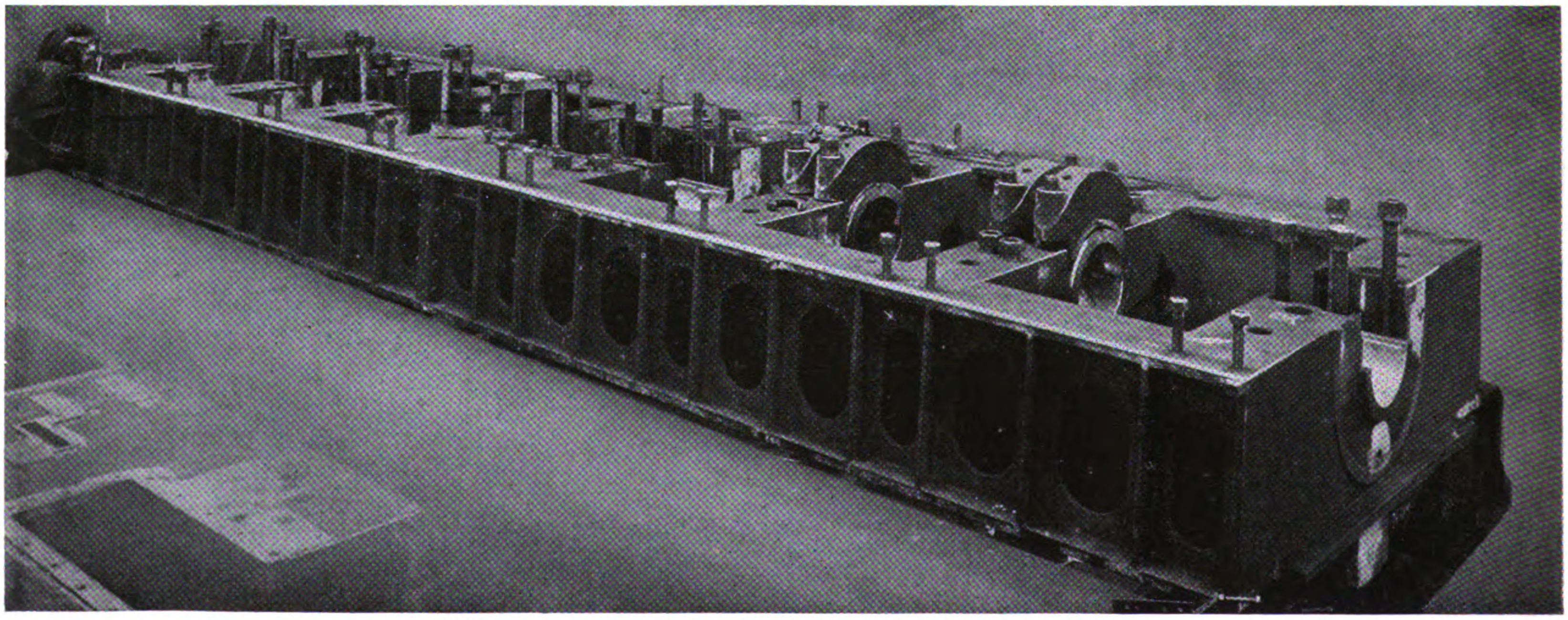
View of the main machine-and-erecting shop at the Cramp shipyard showing four 2,250 i.h.p. Diesel marine engines under construction in the foreground

chinery as air compressors, ballast pumps, etc., the auxiliary Diesel-engines for the present being built at their New York plant, the De Lavergne Company, who are now a subsidiary of the Cramp Company and have had many years of experience in constructing stationary oil engines.

No special machine tools have yet been installed, the existing equipment having been found adequate for the machinery now under construction. They have, however, been aided greatly by an elaborate system of jigs, over $80,000 having been spent on these alone for their Philadelphia and New York plants, and which is carried out to a greater extent than in Copenhagen. These save much valuable time and ensure great accuracy, as well as interchangeability of parts.

Should the size of the Diesel-engines increase in the near future, Cramps will be able to take care of very large castings, as they have a boring mill in the hydraulic shop which can swing 35 feet, and 15 feet under the tool; also other tools of large capacity. These machines, of course, are not used at present on Diesel work, because the castings are not sufficiently large to make it an economical proposition, so the smaller tools suffice. The Cramp Company plans to add other special machine-tools to handle the work when orders justify the investment involved.

The left bay to this machine-shop is served by two 30-ton Niles overhead cranes, these serving



Bed-plate of one of the Cramp B. & W. Diesel-engines for the American-Hawaiian company's motorships

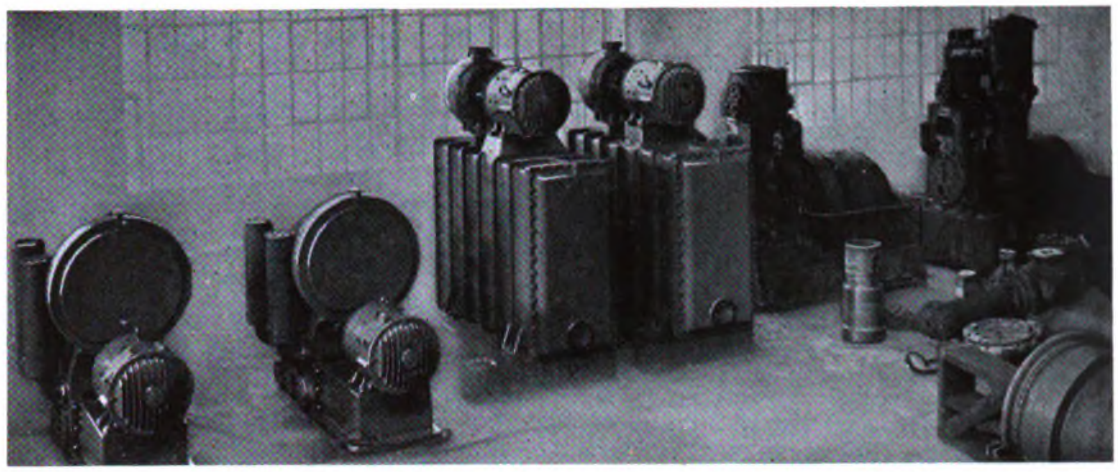
the large machine tools, while the smaller tools in the right bay are served by two 10-ton Niles cranes. In the center bay there are two 50-ton electric cranes made by Wm. Sellers & Co. of Philadelphia. In the lofty galleries round the main shop are the machining and erecting stations for all of the small parts.

In the foundry, which is a building 453 feet by 74 feet, there are two cupolas, the newest one being of 30 tons per hour capacity, and the older of 12 tons per hour capacity. Here the castings for their own, as well as other makes of Diesel-engines, are molded and poured. However, some of the parts are made in a special air-furnace at their De Lavergne plant, where it is necessary to hold the mixture to close limits.

Naturally there have been a few minor refinements to the Danish design made by Cramps to conform better with American practices and conditions, but in the main the Burmeister and Wain plans have been faithfully followed.

The four main engines are similar to the two installed in the M/S "William Penn," which have been working so excellently for the past two months. Each engine is of the direct-reversible single-acting crosshead type and operates on the four-stroke cycle, and has six cylinders 29⅛ in. bore by 45¼ in. stroke, developing 2,250 i.h.p. at 115 r.p.m. This corresponds to 375 i.h.p. per cylinder and a piston speed of 870 ft. per minute with a mean indicated pressure of 85.5 lbs. The weight of each engine complete is about 271 tons (2,240 lbs.) and the overall length 43 ft. 6 in.

The auxiliary engines are similar to those installed on the M/S "William Penn," there being four per ship, however, instead of three, due to the larger number of winches employed on the later vessels. As the general design has frequently been discussed in "Motorship," we do not propose to redescribe the same at this time.



Ballast-pumps, fresh-water coolers and auxiliary air-compressors, all Diehl electrically-driven for the motorships "Californian" and "Missourian"

NORTH GERMAN LLOYD MOTORSHIP WITH VULCAN ENGINE

A single-screw Diesel-driven motorship now building at the Vulcan yard at Stettin for the Nord Deutsche Lloyd is of 6,250 to 6,300 tons d.w.c. The Diesel-engine for this vessel is of the four-cycle crosshead type, and is being constructed at the Hamburg plant of the Vulcan company. It develops 1,800 shaft h.p. at 100 R.H.P. from six cylinders, 28.740-in. bore by 49.212-in. stroke. The auxiliaries will be of Vulcan design and construction. The air compressor is driven off the engine by rocking levers. Forced lubrication is adopted for the engine, and the crankshaft is from forged steel in two sections.

THE OCEAN-HARVESTER "LYBECK"

In our November issue it is stated that the Dodge oil-engines of the ocean-harvester "Lybeck" were to be removed and replaced with a Diesel-engine of a much higher power. We have been advised by the Dodge Manufacturing Co., that no immediate plans are under way for the replacement of the present Dodge engines.

GROWTH OF MOTORSHIPPING

In view of the interest attaching to the great development which has taken place in the use of internal-combustion engines in recent years, it is thought that the following Lloyd's statistics upon the subject will not be inappropriate.

Recorded in Register Book—	Motor vessels		Gross tons
July, 1914	297	of	234,287
July, 1919	912	of	752,606
July, 1920	1,178	of	955,810
July, 1921	1,473	of	1,248,800

The list below does not include the motorships registered with the American Bureau, British Corporation, Italian Register Navale and the Bureau Veritas, but, only includes vessels registered with Lloyds. It is interesting to note nevertheless that while the number of new steamers dropped in 1920-1921, new motorships increased, denoting the growing faith and interest in this class of vessel.

Of the 1,473 motor vessels mentioned in the above table as being recorded in the Society's Register Book for the current year, 287 are of 1,000 tons and upwards. Of these, 125 have tonnages ranging from 1,000 to 2,000 tons, 97 are from 2,000 to 5,000 tons, 44 are from 5,000 to 7,000 tons, and 21 above 7,000 tons. Nearly one-half of the smaller vessels depend solely on their motors for their motive power. Amongst the 287 vessels of 1,000 tons and above, 95 are provided with considerable sail power, and are recorded in the Register Book as "auxiliaries."

It looks as if the slump in steamer building will be the finest thing possible for motorship construction.

Period	Total Steam and Motor Tonnage Classed Gross tons	Type of engines. Steam Reciprocating Gross tons	Steam Turbines Gross tons	Motors Gross tons	Motive power Coal Gross tons	Oil Gross tons
1918–1919	3,760,806	2,633,570	1,051,302	75,934	2,491,213	1,269,593
1919–1920	4,186,882	2,821,031	1,286,046 (all geared)	79,805	2,111,289	2,075,593
1920–1921	3,229,188	2,373,067	754,513 (all geared)	101,608	1,260,465	1,968,723

H. M. Robinson, President, Merchant Shipbuilding Company

A PROMINENT SHIP CONSTRUCTOR

In view of the great interest now being displayed in motorship construction by the Merchants Shipyard of Chester, who are building two motorships for the American-Hawaiian Steamship Company, doubtless some information concerning one of the prominent officials of this Company will be of interest to readers of "Motorship."

We refer to Mr. H. M. Robinson, who holds the offices of president of the Merchants Shipbuilding Corp., president of the American Ship & Commerce Corp., president of the American Ship & Commerce Navigation Corp., chairman of the executive committee and acting president of the United American Lines. He is a director of the Cramp Shipyards at Philadelphia and of the W. A. Harriman Company, a banking house specializing in marine securities.

Mr. Robinson graduated from the U. S. Naval Academy in 1896. He was then sent by the Navy to the University of Glasgow, where he remained until 1898, studying naval-architecture, marine and civil engineering. Returning to the United States, he was assigned to the Cramp Ship Company's yard as superintendent of naval construction and occupied this position up to 1902.

From 1902 to 1905, he was assigned to the New York Navy Yard in charge of the construction of the U. S. S. Connecticut. During this time he organized a construction force at that yard. From 1905 to 1913, he was in charge of the design and construction of all naval ships. In 1913, he resigned from the Navy and became managing director of the Lake Torpedo Boat Company at Bridgeport, which position he occupied until he became connected with the Harriman marine interests on the 1st of July, 1917.

Mr. Robinson was president of the Chester Shipbuilding Company, Ltd., and of the Merchant Shipbuilding Corporation (Harriman, Pa.). These companies were eventually amalgamated under the name of Merchant Shipbuilding Corporation, Mr. Robinson remaining president. He was president of the Independent Steamship Corporation.

"MOTORSHIP" ASSISTS SALESMAN SECURE ORDER FOR OIL

In conversing recently with a salesman for one of the leading oil-companies a representative of "Motorship" was pleased to listen to a story of how a copy of the magazine helped this salesman sell oil. It seems that one day an Italian motorship came into a port in Texas at which the salesman was stationed and needed a supply of fuel-oil. When this salesman went aboard he carried a copy of "Motorship" and as soon as the chief-engineer saw it he looked through it eagerly. The leading article was about his own ship—namely, the "Ansaldo San Giorgio I"—illustrating the vessel and also the machinery, himself and engine-room crew. The oil-salesman spent considerable time collecting from his friends all the copies of this issue of 'Motorship" he could lay his hands on and the chief-engineer felt that a man who represented a company which at that time advertised its products in "Motorship" was better posted on Diesel-fuel than some others and gave the order to him. The oil-company has received the business from this motorship ever since. The owners of this ship thought so much of this article that they had 500 reprints made for distribution to their shipowner friends.

A Diesel Engine That Burns Tar-Oils

The Steinbecker Engine Now Being Developed by Krupps

Our readers are undoubtedly well aware of the fact that since the war German manufacturers are taking up with renewed interest the manufacture of Diesel-engines; Germany gave up her steamships to the Allies and is now building Diesel-engines and motorships with such enthusiasm that Americans would do well to keep informed as to developments there. Germany is bending every effort to realize a future on the sea with her merchant-marine. That future for any nation must hinge on a realization that steam-vessels are not fitted to survive this competition which has already begun in good earnest, and that the ship which will survive is the motorship driven by oil-engines, those operating on heavy-grade oils having great advantages over others.

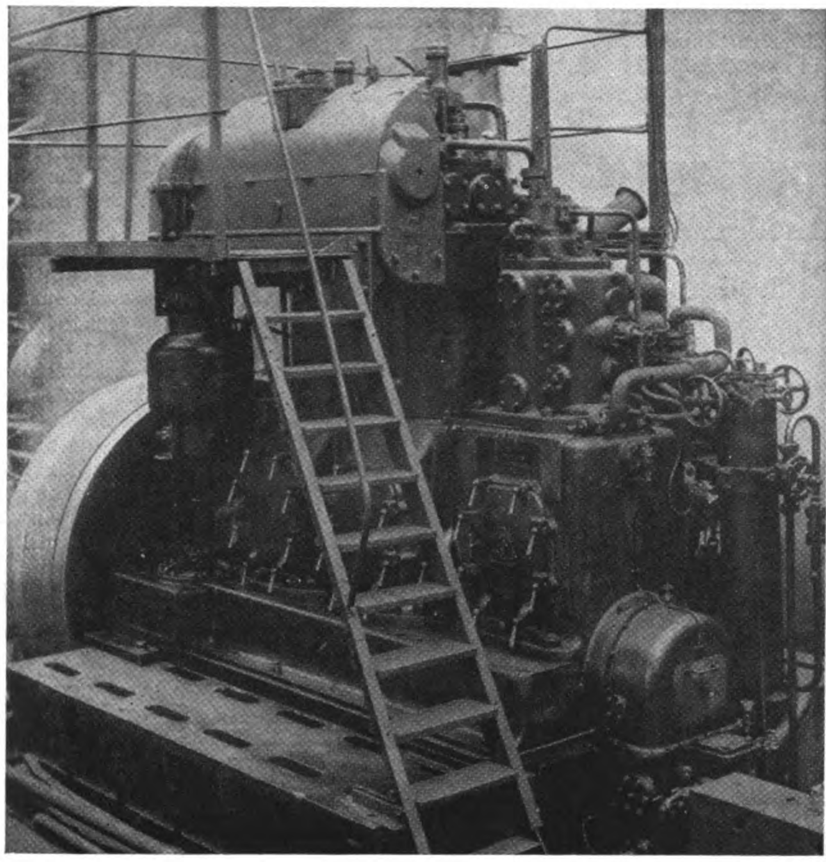
The engine of the future probably must be able to operate continuously on coal tar-oils as well as asphaltic- oils. While the problems to be solved in the design, manufacture and operation of such engines are now greater than those connected with engines utilizing lighter fuel oils, experience will solve them; the world's supply of the more volatile oil-fuels is not inexhaustible and sooner or later the heavier fuels must be quite commonly used.

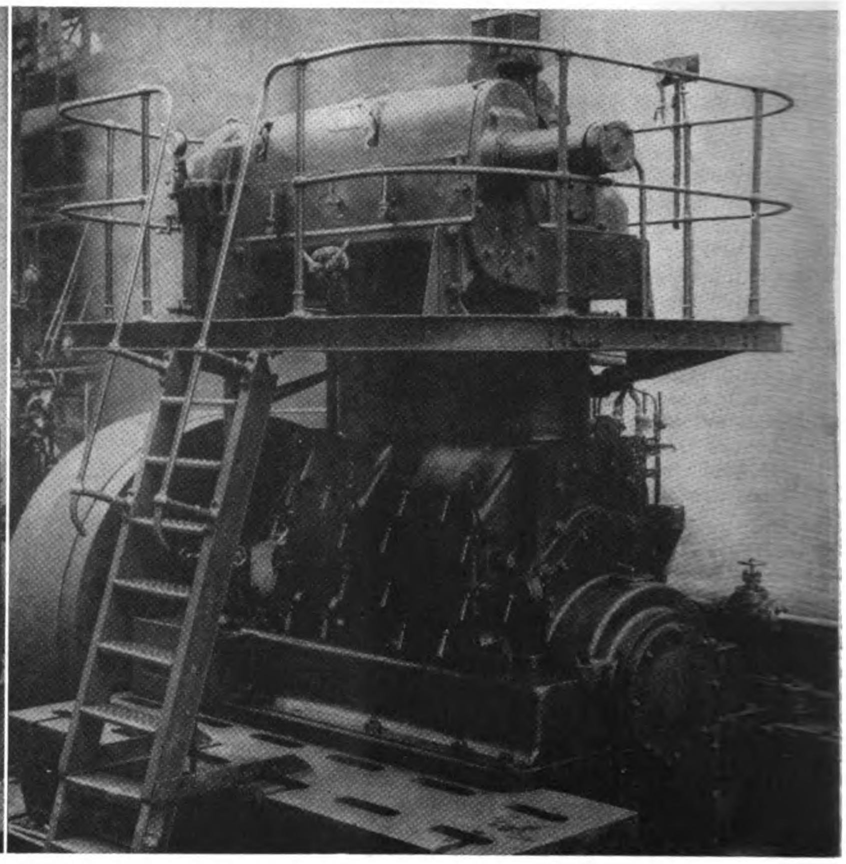
One of the German firms devoting much attention to the development of engines burning very heavy-oils, such as tar-oils, is Fried Krupp, Germaniawerft, Kiel-Garden, Germany, who in addition to building their own crosshead and trunk-piston types of Diesel-engines, have a license for the manufacture of the Steinbecker engine, as previously announced in "Motorship." The first 100 h.p. two-cylinder engine has been developed under the personal supervision of the inventor, Mr. Steinbecker.

The Steinbecker engine our readers will remember has no compressor and might be called a combination of the surface-ignition and full-Diesel principle. The principle of operation is as follows: Toward the end of the compression-stroke the fuel-pump forces a small quantity of oil through the horizontal-channel into the vertical-channel, the top-end of which is fitted with a bulb with a number of spray-holes, the bottom-end being open to the cylinder. As the air rushes from the cylinder into the bulb it atomizes the oil in the same manner as water is atomized in a flower-spray as used by florists, and the mixture of air and oil is carried into the bulb. When the piston reaches the top of the stroke this mixture of oil and air is ignited by the heat produced by compression, resulting in great increase of pressure and a back-rush of the burnt gases which carry into the cylinder the oil-fuel which the pump has meanwhile pumped into the vertical-channel. In the cylinder the mixture burns and expands in the same manner as in other Diesel-engines.

It will thus be seen that this Steinbecker engine is a Diesel-engine without a compressor, which atomizes the fuel-oil by blowing it with great velocity into the combustion-chamber by means of gases which are formed by exploding a small amount of fuel-oil in a hot retort. The engine is claimed to be less complicated and therefore cheaper to build than the usual full-Diesel type; the fuel needle-valve, injection air-bottle, air-compressor, and high-pressure air-piping are eliminated. For starting the engine from cold a small auxiliary-sprayer is provided, which may be put out of action when the engine is running.

Our illustration shows Krupps' first-engine on the Steinbecker principle. On page 729 of our September issue of 'Motorship" we published reference to the visit of Mr. R. Hildebrand, engineer of the oil-engine division of the Fulton Iron Works of St. Louis, Mo., through the Krupp works, where he saw Steinbecker motors under test. Complete articles and illustrations on the Steinbecker engine were also published in 'Motorship" for July and August, 1920.





On the left, Krupp twin-cylinder air-injection Diesel engine of 160 b.h.p. On the right, Krupp-built Steinbecker engine of exactly same dimensions and power. This shows the larger space occupied by the air-injection engine due to its compressor

"MOTORSHIP" MESSAGE READ AT THE MARINE SHOW

Thro' the courtesy of the Westinghouse Electric & Manufacturing Co. the following message was read at the New York Marine Show through the wireless telephone at their plant in Newark.

"The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by economical internal-combustion power. America, the most important oil-producing country, should be the greatest motorship owning nation. Let us all co-operate and assist to make that day come soon."

"Under pressure of war conditions and the abnormal period following the war, our Shipping Board has presented us with several thousand uneconomical steamships. Half of these vessels are laid-up and many will never go to sea again in their present condition. Too many billions of dollars have been spent to let our merchant-marine drop out of sight. We must formulate a plan whereby the investment of a little additional money will leave us with a fleet that is economically sound and which can compete with vessels of any other nation. In order to do this several hundred of these ships must be converted to Diesel-drive or to Diesel-electric power. The work should be in the hands of ship-owners under guarantee from the Government, and under the supervision of the Shipping Board. This, at the same time, will give much needed employment to our shipyards."

A HANDSOME SOUVENIR

We are in receipt of copy of a very handsome book entitled "Record of Ships Built" from the New York Shipbuilding Corp, at Camden, N. J. The book is printed on cameo paper somewhat similar to the paper used in the Special Schneider Supplement published in 1919, so that readers will have an idea of the excellency of the New York Shipbuilding Corp's book. It is profusely illustrated with the principal vessels built at this yard, and also contains a picture of their new 200-tons hammerhead crane. These vessels illustrated vary from steel car floats and freighters to the largest battle-ships. Only a limited edition of this volume has been published for distribution to a selected list of steamship owners, so early application should be made for the few copies that remain at their New York office.

The Sperry Compound Marine-Oil Engine

An Engine of Unusual Design and Operation

ON another page in this issue is a criticism of the turbine-electric drive by Elmer Sperry, the well-known electrical scientist. Consequently the present is an excellent opportunity to give some information respecting the new compound type of marine oil-engine now being developed by the Sperry Gyroscope company at their Brooklyn plant. Several of these engines have been ordered, including a set for a fishing-vessel in southern waters. The principle on which this engine operates differs vastly from any motor now on the market. It is very ingenious in design, and experiences with the first engines in coastwise service will demonstrate whether or not it is suitable for regular commercial adoption, particularly in the hands of unskilled operators like fishermen, and on heavy boiler-oils such as will have to be used by most work-boats in the near future.

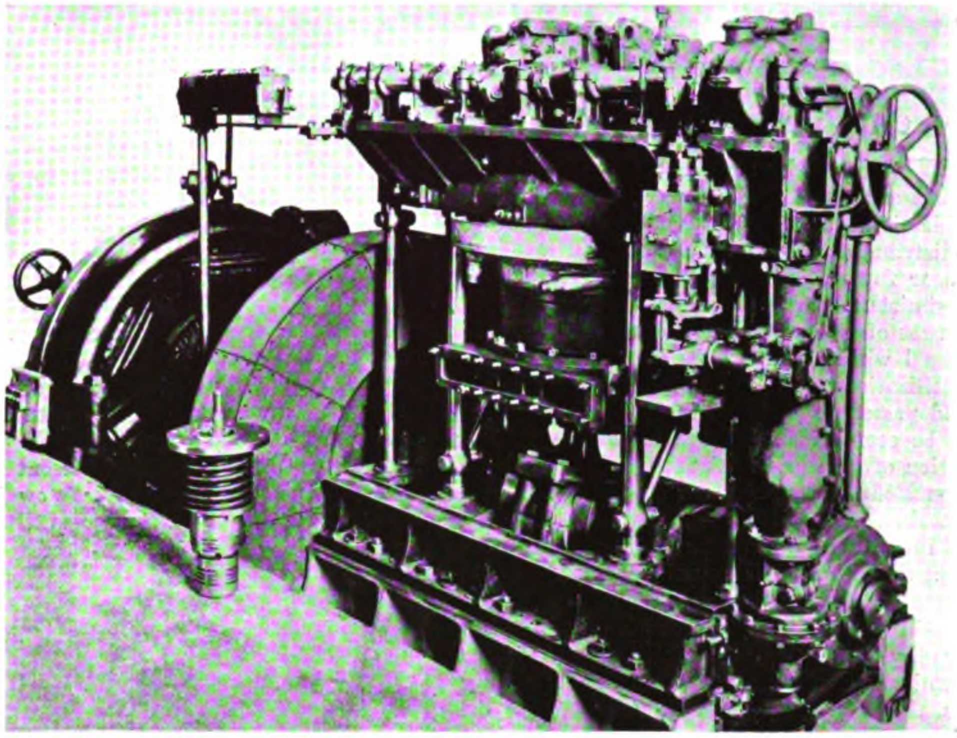
The smallness and lightness of this compound-engine is due to the following. In the four-cycle Diesel we have the tonnage of metal due to the presence of high pressures, operating at a comparatively low material efficiency because these high-pressures persist only about 2½% of the total time. The Diesel card rises abruptly and quickly falls. All the rest of the time, over 95%, either low pressures or no pressures at all are present, whereas in the compound the pressures persist and we are dealing with great blocks of power. Although the pressures are not materially higher than in Diesel practice, they are made to persist practically clear across the card, producing very large gross mean effectives. This is instantly followed by another line clear across the card, again producing another large gross mean effective in the low-pressure cylinder when referred to the high pressure area, all from a single fuel injection.

Instead of 60 lbs. to 80 lbs. net mean-effective to the crank, delivering its power through a few degrees only of one stroke in four, in the compound we have two net mean-effectives, each of 300 to 400 lbs. per sq. in., succeeding each other and covering two strokes out of the four from a single fuel-injection, giving very much better crank effort distribution for power purposes. The point of paramount interest is that these two large blocks of power are secured not by any material increase of pressures, but by large quantities of power gases, simply by "hanging on" to the pressures we have in those gases throughout practically two complete strokes, clear across the card twice, thus abstracting much more of the power they contain before exhausting. Suppose these to be 330 lbs. per sq. in. each. Added they make 660, which is nearly ten times the net mean-effective frequently met with in ordinary Diesels. In an engine of simple construction giving ten times the net mean-effective to its crank-shaft and well distributed, there would appear to be no good reason why it should weigh more than one-tenth the weight of a Diesel of the same speed.

The power-gases work in the Diesel about 120° of arc and in the compound 315°, or 2.6 times as long, or, considering the points of "cut-off" in each, the true expansion-curve is 3¼ times as long, which accounts for its large mean-effectives and higher economies.

Regarding the construction of the Sperry engine: on either side of the low-pressure cylinder are the two high-pressure cylinders and their pistons. The sturdy construction for an engine of its speed is indicated by the size of the crank-shaft, the same being considerably larger in diameter than in any other combustion engine, approaching, as it does, the bore of the combustion-cylinders themselves. The combustion-chamber of the compound has a large dome, which stands out in marked contrast to standard Diesel practice. This dome forms an upward extension of the combustion-cylinder, extending also in a large sweep surrounding the transfer valve, which seals the transfer port.

Seated on top of the transfer valve is a sleeve-like induction-valve and which is controlled by a cam-operated fork. The transfer-valve and sleeves are lifted by a fork located in a thimble near the top of the stem. The first-stage annual compression-pump surrounding the trunk-piston below the low-pressure piston proper, delivers its air to a small receiver, which in turn discharges to a cored port surrounding the induction sleeve, the cooling action of which has been described. A little balancing-cylinder sustains a permanent connection with the low-pressure cylinder. The solid fuel-injection valve and nozzle are placed approximately over the center of gravity of the large masses of air in the clearance dome.



New Sperry heavy-duty, light-weight Diesel-cycle engine operating on bunker-oil. For heavy-duty characteristics see crank-end of rod, center in foreground. Crank-shaft measurably same diameter as the combustion cylinders. The standard generator constituting full load in background, is heavier than the engine, which weighs about 30 lbs. per B.H.P.

Operation of Tug "Foss No. 16"

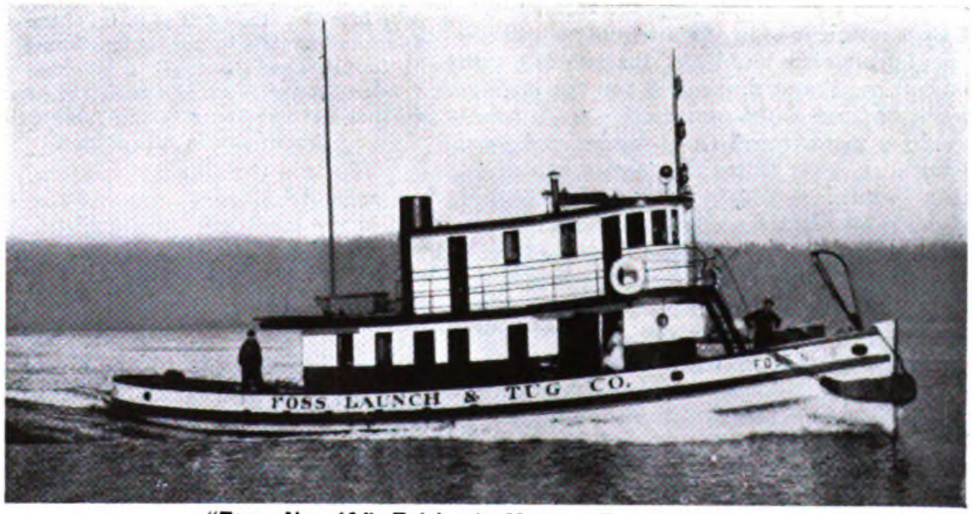
Steam Driven for 11 Year—Now Has Oil-Engines—Details Resultant Economy

The Foss Launch Company, of Tacoma, Washington, owners of "Foss No. 16," did not take out the steam-plant and install in its place a surface-ignition oil-engine because of sentiment. From 1909 till 1920 her 8x16x14 compound steam-engine had driven this tug in her work, but her owners, who also operate twenty-two other tugs, felt that oil-engines would give them every bit as good service with great reduction in operating costs. Out came the steam-plant, and in its place was installed a 200 h.p. Fairbanks, Morse oil-engine.

What happened? She now costs for fuel about one dollar per hour to run as against about $2.50 per hour with the former steam-plant; two men less are needed in the engine-room; she handles larger tows with quicker action than previously, and is so reliable and efficient that they arefiguring on other similar boats in the near future. With the old steam-plant she towed 300,000 to 400,000 feet of logs from Shelton to Tacoma in 24 hours and couldn't handle any more; she now tows one million feet without trouble.

"Foss No. 16" is 60 ft. long, 16 ft. breadth and has a regular steam tow-boat hull of heavy construction. She has towed the "Griffson," a 2,200-ton vessel from Seattle to Tacoma, a distance of 32 miles, in 4½ hours and has also towed the sailing-vessel "Henry Villard," of 1,553 tons, from Eagle Harbor to Tacoma in 5 hours, which is a speed of better than 6 knots.

Her record is convincing evidence that the oil-engine is bound to take its place very prominently in the tow-boat fleet of the country. The Carey-Davis Towboat Company, of Seattle, Washington, which owns a fleet of nine steam-tugs, has decided to convert the whole fleet to oil-engine power and the work has started, the first tug to be changed being the "Equator," which now has a steam-engine. The Puget Sound Tug Boat Co., have sold most of their steam-tugs and have had plans drawn up for a 245 foot 2,600 ton 2,400 h.p. Diesel-tug upon which construction will shortly commence as previously mentioned.



"Foss No. 16," Fairbanks-Morse oil-engined tug

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MOTORSHIP

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DIESEL ENGINES AND HEAVY BOILER-OILS—THE PRESENT FUEL-OIL SITUATION—NEED OF CO-OPERATION OF OIL-COMPANIES AND ENGINE-BUILDERS

LATELY we have given much thought to the fuel-oil question, and have been in consultation with authorities on the subject with the result that we consider it advisable to offer a timely suggestion to oil-engine builders and oil-distributers, which if followed will avoid a grave situation arising in the near future. All our readers are aware that at no time have we been pessimists, although we know there is real necessity for conservation of all classes of oil and that the waste of heavy-oil under boilers should be made illegal within a few years in all cases where means for more economical utilization for the same power purposes can be made, such as in cargo and passenger ships up to 20,000 tons and 8,000 horse-power. This oil must be economically burned in Diesel-engines. Oil experts differ on the question of oil supply. A few weeks ago H. G. James of the Western Petroleum Refiners Associations stated that the oil-industry are worrying over a market, not a supply and that there are over 150,000,000 barrels of crude-oil in storage and greater production in prospect. But the situation is actually serious.

During recent months, however, the price of Solar-oil—termed Diesel-oil in the marine field—has been steadily increasing, and in all cases where oil-companies have adequate refineries and cracking processes, the cost of this fuel-oil undoubtedly will increase in a few months hence to a figure way beyond the highest yet touched during the abnormal period that followed the war. In fact, at least one big oil-company would like to withdraw Diesel-oil from the market to-day. Several important foreign motorship owners have foreseen this situation and have built moderate-sized Diesel-driven tankers that can economically cruise to oil-fields in the Mesopotamia or Java districts, where such fuel is cheaper owing to local conditions preventing facilities for close refining. Thus they will be able to bunker their motorships at moderate prices. Boiler-oil, however, will not increase in cost to any appreciable extent until the supply runs low because of the competition it must face from coal.

The late Dr. Rudolf Diesel, inventor of the Diesel-oil engine, to perpetuate whose name it is proposed that oil companies grant funds to American Universities to carry out further developments in the combustion of boiler-oils in oil-engines.

Hitherto the "proportionate-difference" in prices between Diesel-oil and boiler-fuel, i.e. residual-oils, has not been sufficient to necessitate motorship owners always burning the heavier of the two oils with its attendant work and discomfort for the engine-room crews, because of the comparative small quantity used by a motor-vessel on an overseas voyage. Also, because on some routes the surplus bunker-oil was easily disposed of as cargo at a profit, as outlined on page 728 of our issue of September last, since when a change has occurred in the oil situation. When boiler-oil and Diesel-oil were $6.00 and $7.00 per barrel respectively, the "proportionate benefit" derived by using boiler-oil with Diesels was not as great as it is to-day with oils at much lower prices, and with the variation between the two rapidly widening.

For instance, on a transatlantic round-voyage, a 10,000 tons dead-weight 12½ knot oil-fired steamer burned 1,100 tons at sea (42 gals.=1 bbl.; 7 bbls.=1 ton), and a Diesel-motorship of similar tonnage and speed only burned 375 tons; or, with oil at the above prices fuel-bills of $46,200 and $17,775 respectively. Whereas, if the motorship had been using the boiler-oil as fuel, her bill would have amounted to $15,750 giving her an additional saving of but $2,005, which in those days of full cargoes and high freight-rates was but a small item, especially as it was more than offset by the earning power of her larger capacity. The motorship's fuel economy in port we have not taken into consideration.

It will be readily realized that the more expensive oils become, the greater the economy shown by the motorship compared with an oil-fired, or coal-burning steamer—provided coal, boiler-oils and Diesel-oils rise on an equal scale, or provided the motorship bunkers boiler-oil. Unfortunately, these prices will not rise on an equal scale. But if the cost of boiler-oil mounts too high, steamers will have to be converted back to coal-burners to the detriment of the oil-companies. Alternatively if coal drops below $6.00 per ton it means that boiler-oil will have to be sold to *steamers* at a loss if oil is to remain a competitor of coal, of which fact the oil-companies are well aware. On the other hand, motorships using boiler-oil could compete with coal-burning steamers using coal at $1.50 per ton if the price ever dropped so low. This fact should cause oil-companies to do their utmost to encourage the construction of Diesel-driven vessels.

Towards the end of October, we obtained prices on boiler-oil and Diesel-oil from four leading oil-companies, the same for delivery in New York harbor, as follows:

	Boiler-oil (Prices per bbl.)	Diesel-oil (Prices per bbl.)
A	$1.70	$3.04
B	1.77	2.61
C	1.70	220 to 2.31
D	1.68	2.20

This gives an average of $1.71 per barrel for boiler-oil and $2.52 for Diesel-oil. On this basis the fuel-bills of the steamer and motorship referred to above will be $13,167 and $6,625 on the same voyage. But, if the motorship burned boiler-oil, her fuel-bill would be reduced to $4,421, making a possible saving (compared with the steamer's bill) of $8,746 on the same voyage, which is more important to-day than was the much greater saving effected two years ago. Because, with ships running half loaded to-day the motorship only occasionally takes advantage of her larger cargo-carrying capacity, hence operating economy is paramount. Thus here is an excellent reason that at the present time motorships should burn the heaviest oils unless on a route where surplus Diesel-oil can be remuneratively sold abroad to gas and dye companies. This, of course, does not coincide with the theory proffered by Director Blache on page 892 of our last issue. While we would like to agree with his argument, loss of twenty-five percent bunker-capacity due to the tanks becoming coated with residue just now is of minor count, because there will be no cargo to take its place until the normal overseas trade is with us all once more.

In some ports abroad such as Italy, the price of boiler-oil is $18.00 per ton compared with $36.00 for Diesel-oil, due to expensive storage-tanks being required and oil kept on hand for long periods, as motorships utilize their great cruising radius to bunker where it is cheapest and only buy in Europe when forced. But, when the Standard Oil opens-up its new Polish concessions Diesel-oil may be offered at moderate prices in some nearby European ports for several years to come.

There is another factor to be considered. Lately, owing to so many oil-fired steamers being laid-up for lack of cargoes large quantities of the heavy-oils have accumulated, which fuel the oil-companies have an abundance and naturally are desirous of disposing prior to the cleaner fuel. Because, for the latter they have other markets, especially as several companies can use Diesel-oil in pressure-stills (Burton or similar processes) and obtain gasoline, kerosene, and refined products to meet the steadily increasing demand. Incidentally, if the town-gas standard is changed in the near future, the demand on land for Solar-oil will slightly decrease, but the greater demand for gasolene will more than offset this.

Consequently, it is very advisable for all oil-engine builders immediately to give further attention to the design and construction of fuel-injection systems, providing heating-coils in day-tanks and bunkers, and furnishing ample sized lines for the free flow of sluggish liquid, in order that reliable operation may be ensured with heavy Mexican and Texas residual-oils when in the hands of engine-room crews that might be more skilled and experienced than they sometimes are.

The latter matter we mention because some American motorships have gone to sea with engineers who certainly are hardly entitled to licenses, if their knowledge of Diesel-engines counts. On all sides we have evidence that a Diesel-engined motorship when in the hands of good engine-room staff can operate without any trouble on the heaviest of oils. For instance, one U. S. coastwise motor-tanker has been running with splendid success on Mexican boiler-oil of 14.5 degrees Beaume, 0.9685 gravity and with 4.365% sulphur content, no trouble with her exhaust and inlet valves resulting. She has American-built four-cycle Diesel engines. To enable this very heavy-oil to be used, a fuel-heating system has been installed,

consisting of heating-coils in the silencers in which fresh-water is heated by the exhaust-gases. This hot-water is then passed through coils in the fuel-service tanks. In the silencer a coil also has been installed for the auxiliary oil-engines. When the main-engines are cold they are started and run on 0.92 gravity oil for about ten minutes, then the heavy-oil is turned on. It has a viscosity of 1,000 sec. Saybolt at 150 Fahr. The main engines have run for over 450 hours at sea on this fuel, and the fuel-consumption of these twin 500 brake horse-power engines have been reduced by over three barrels a day. The sulphur had no effect on the exhaust-valves. Ever since she was placed in service the motor-freighter "Kennecott" has been burning boiler-oil of 16.7 degrees gravity with most consistent reliability. She also has American-built four-cycle Diesel engines. Many other cases can be quoted. The Doxford engine, for instance, has been using Mexican low gravity oil exclusively.

However, in indifferent hands the use of such thick and sulphuric fuels on board motorships is not altogether desirable, but it can be made so by deeper investigation into oil-fuels, their atomization, and their combustion by domestic engine-builders in conjunction with the leading oil-companies. Also lectures on its use should be given before members of the M.E.B.A. In fact, it would be a good business investment for the principal oil-concerns to stand their share of the cost and this we urge them to do in their own interests. This could be done by making a substantial grant for this purpose to several of the leading American Universities, such as the Massachusetts Institute of Technology at Cambridge, Columbia University in New York, the University of California, Ohio State University, etc., with the understanding that they co-operate with the leading oil-engine builders of this country in carrying-out a series of thorough tests and exhaustive experiments on the lines of those carried-out in England by Lieut.-Engineer Commander Hawkes, which have proven highly valuable to British engineers. Also the Shipping Board and the Navy Department could lend financial and engineering assistance.

A good Diesel-engine could burn and operate on anything from garbage to coal-oil, if it could be reliably and consistently injected and pulverized. Consequently, there is no reason why this wonderful engine cannot be made to run with every reliability on the regular grades of boiler-oil when in the hands of the average set of marine-engineers that go to sea in American ships. "Motorship" has secured for its readers a valuable series of articles dealing with the use and methods of combusting coal tar-oil with Diesel-engines in Germany, where exhaustive experiments have been carried-out over a number of years. American coal companies should study this treatise.

Let us remember that the inventor, Rudolf Diesel, figured upon only burning coal-dust when he produced his original engine. Using oil was an after-thought. His first motor gave its initial "kick" on pulverized-coal fuel. This proposed grant to the Universities could be given to perpetuate the memory of this great German genius and scientist who died unhonored and unsung, but whose legacy to the world is so wonderful that his name will always be identified with the engine, regardless of the country in which it is made. Even an agitation in England during the height of the war to expunge his name in connection with the design was happily quashed by broadminded engineers and business men. But, it was a very bitter pill to Dr. Diesel that the ex-Kaiser never honored him or recognized his work—altho the Diesel-driven submarine afterwards nearly won the war for Germany—and he went to his watery grave a pauper and heart-broken man, just as his engine had attained success in the merchant-marine. As America will ultimately derive the greatest commercial benefit from the Diesel-engine there now is an excellent opportunity to perpetuate Dr. Diesel's name, and at the same time assist American engineers to attain an objective greatly desired by the inventor himself, also to provide a very steady market for residual-oils regardless of competition from coal, and meet competition from possible production of large quantities of coal tar-oil for bunker purposes.

DIESEL-ELECTRIC DRIVE IN THE NAVY

HITHERTO the electrical power of submarines has only been used when running submerged, the current being derived from batteries charged by Diesel-driven generators prior to submerging. Quite a radical departure is being carried-out with the three new V-class submarines building by the U. S. Navy Department. These boats are of 2,025 tons displacement, 21 knots speed, and of 300 ft. length, and the Diesel-electric system of propulsion will now be used for surface-operation, and electric power when under the water.

Altogether there will be four Busch-Sulzer Diesel-engines, two of 2,250 b.h.p. aft and two of 1,000 b.h.p. forward. Each will be coupled to an electric generator, the current from the entire set being available for the motors on the twin propeller-shafts, giving a maximum of 6,500 shaft h.p. less the loss in transmission, which we presume will be about 500 horsepower. Under normal cruising conditions, only the forward pair of Diesel-electric generator sets will be run, or sufficient to give a speed of 11 knots, and a radius of about 10,000 miles. A five-inch gun, machine-guns, and six torpedo-tubes will form the armament.

It is, of course, very interesting to note this development, but we would also like to see the Navy Department turn more attention to Diesel and Diesel-electric driven surface-craft of high power. Submarines have proven to be very effective weapons of both defense and attack, but adequate counter-weapons must be developed, and we believe that fast Diesel or Diesel-electric destroyers of moderate size and 20 to 30 knots speed would be the ideal craft for this purpose, as we strongly advocated during the war.

ANOTHER SUGGESTION FOR THE SHIPPING BOARD

IF a business man had manufactured a large quantity of articles, had offered them for sale at a low price, and had found few or no buyers, he would be facing the unpleasant choice between carrying them on his shelves as a fictitious asset, incurring continual expense for their care and insurance; or selling them for junk, and writing off his loss. And if, under such circumstances, he ascertained that, by making certain changes and additions to the articles, he would be able to sell many of them at the price he had originally asked plus the cost of such changes and additions, is there any doubt as to the course he would pursue?

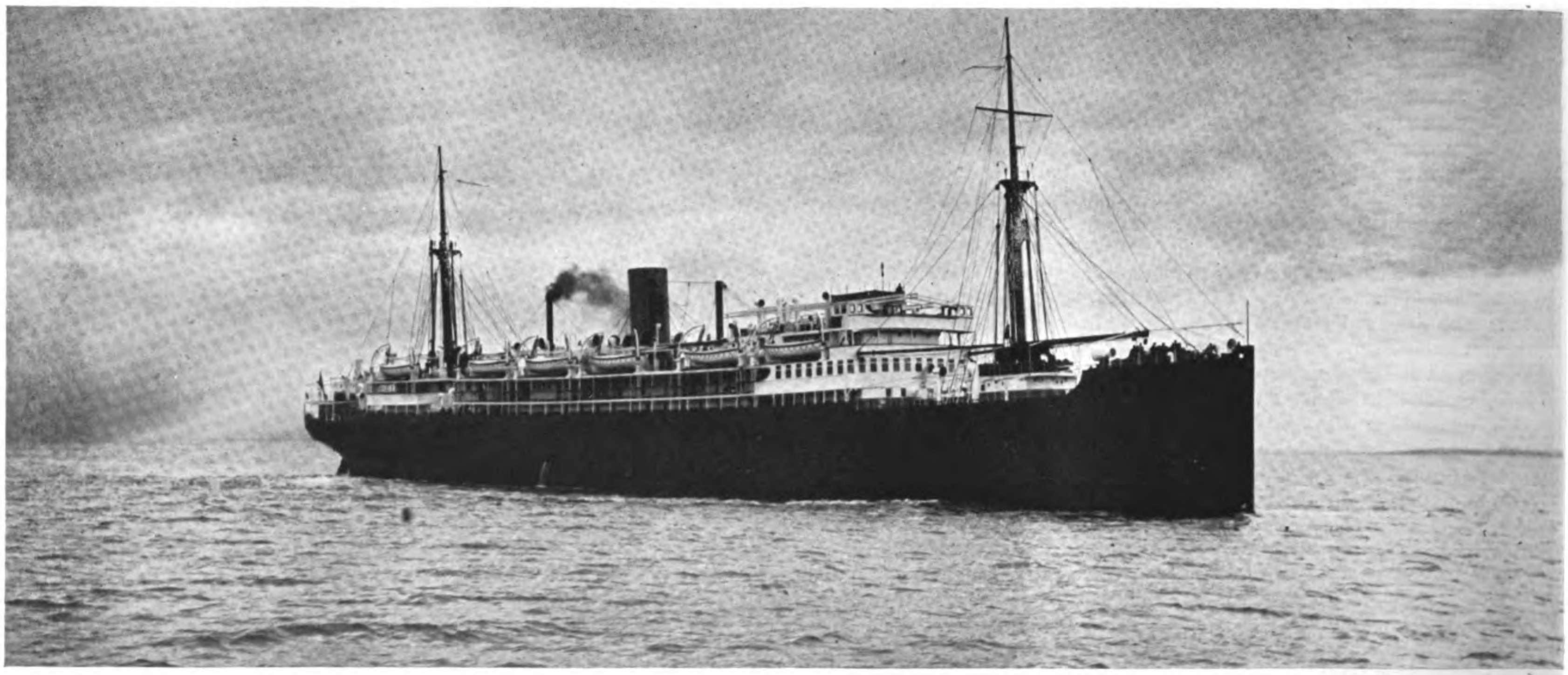
Isn't this exactly the position in which the Shipping Board finds itself today? It built hundreds of steamships, which it is offering for sale at prices far below their current replacement cost and on almost unbelievably easy terms of payment—yet, instead of anxious purchasers fighting for them, there are practically no buyers in sight.—Why?—There are more or less obvious explanations in the case of the wooden ships; but even the best steel ships are faring no better. The plain answer is that, in their ability to compete with modern motorships, of which Europe is putting so many on the seas, these Shipping Board vessels, equipped as they are with reciprocating steam-engines or steam turbines, are rapidly becoming as obsolete as side-wheelers.

The Shipping Board can continue to offer the ships in their present condition, at progressively lower prices and with continued lack of success, meanwhile spending large sums for their maintenance, and writing off yearly a heavy depreciation, with the scrap heap (or, as "Importer and Exporter" recently blithely suggested—Davy Jones's locker as the ultimate goal); or it can transform many of them into attractive bargains, by substituting modern machinery equipment, to take the place of their present moribund outfitting. There is the alternative of "allocating" them to private operators; but it appears doubtful that this course has proved attractively profitable to the "allocatees," while it has been hugely unprofitable to the "allocators"; in any event, there are no evidences of keen competition for such allocations, even on terms which appear to relieve the operator from direct losses in operation, by transferring them to the long-suffering taxpayer.

We are not presuming to assert that the steamer is entirely a "dead issue." There are certain classes of service in which the steamer may be operated more economically than the motorship so long as the first cost of oil-engine machinery is greater. We do contend, however, that the service which would favor the steamer is not such as the majority of the Shipping Board's best ships would be likely to be used in,—namely, general trans-oceanic cargo carrying. Even in the latter service, steamers will still be operated, more or less profitably, during periods when the cargoes offering are in excess of the available motorship capacity—a more and more remote condition. The day has passed, however, when, in the service referred to, the superior profit-earning ability of the motorship could be questioned. This fact has been forcibly demonstrated during this year's dull business period, when cargoes were very sparse. This is logical, under the existing circumstances, because of the ability of the motorship to be operated profitably with cargoes much below the minimum essential for the equivalent steamer to pay actual expenses.

Last month we made one suggestion for profitable disposal and conversion of some of these ships, but it is just as well to have an alternative plan, especially as the operation of even the best of the Shipping Board's ships—with their present equipment, is not a sufficiently attractive proposition to induce operators to invest their money in them, even at bargain prices and on long terms; whereas the same ships, modernized into motorships, would hold out the assurance of a sufficient return on the price at which the steamers are now being offered plus the cost of the reconditioning, to stimulate the purchase of such modernized ships. We are not overlooking the fact that this reconditioning will require money, and that, at the moment, the public is not greatly in favor of increasing its investment in ships; but, after recovering from the shock induced by the figures recently given out by Mr. Lasher, the public will come to the conclusion that an additional business-like investment, which opens up a reasonable prospect for some return or, shall we call it "salvage"?, is much to be preferred to a continuous drain, with little else in sight than the final engulfment of the original investment and all of the subsequent assessments. Nor is it necessary that such additional investment be made on a large scale at once.

The question which naturally presents itself is—if the ships, as they exist, may be purchased at attractive figures, and the money required for their reconditioning can be shown to offer promise of yielding satisfactory returns, why do not the ship-operators buy the ships and do their own reconditioning? The answer is found in the business conditions of the past twelve months. Money is tight; surpluses have been small or entirely absent; so that ship-operators cannot pay machinery-builders quickly and in full, and machinery-builders cannot carry the operators for long periods. The Shipping Board is the natural bridge across this chasm.



At last, a real trans-ocean motor passenger-liner. She makes 13 knots on a fuel consumption of 20 tons per day compared with 60 to 70 tons for a similar American oil-fired ship. The vessel illustrated above is the Elder-Dempster Co.'s twin-screw Diesel-driven ship "Aba." Originally the transport and freighter "Glenapp," she has just been re-conditioned and converted to a passenger-liner by Harland & Wolff

"ABA," A TRANS-OCEAN MOTOR PASSENGER-LINER

Enormous interest is being taken in the motorship "Aba," as hitherto it had not been thought feasible to equip large passenger-vessels with Diesel oil engines. But Harland & Wolff, Ltd. claim that they have solved the problem, the engines installed by them in this and other motor-vessels having proved eminently successful and capable of long non-stop runs, little short of a revolution being thus effected in marine propulsion.

The "Aba," a twin-screw motor-vessel belonging to the British & African Steam Navigation Company, Limited (Managers—Elder Dempster & Co., Limited, Liverpool), left Belfast on the 3rd instant after reconditioning from a transport and freighter by Harland & Wolff, and is to take her sailing on the Liverpool-Continental-African route during the month. She is the first motorship to be engaged in a regular first-class passenger service. Although she carried passengers in addition to cargo during her war service, it is to fufill her design as a high-class passenger-vessel that the "Aba" now commences her proper career.

The "Aba" is 450 ft. long by 55 ft. 6 in. broad and 33 ft. deep. Her propelling machinery consists of two 8-cylinder 4-cycle Diesel oil-engines of Harland & Wolff type on the well known Burmeister & Wain system, designed to develop 6,600 I.H.P. The engine-room auxiliaries, also the deck machinery and steering-gear, are electrically driven. She carries 225 first and 140 second and third-class passengers.

THE NEW YORK WERKSPOOR DIESEL ENGINE

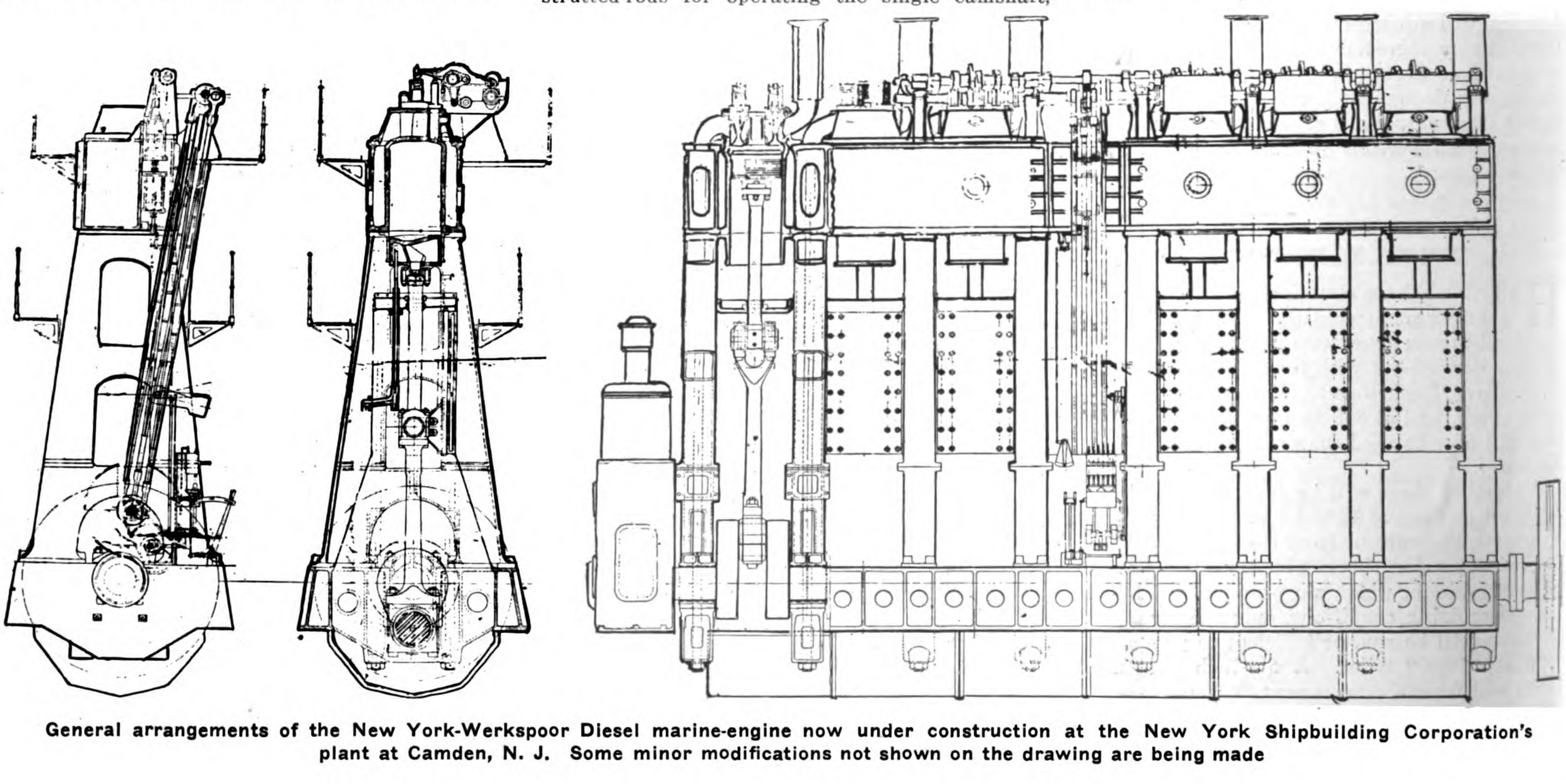
Constructional work on the 2,000 i.h.p. Werkspoor-Diesel marine-engine is being pushed forward by the New York Shipbuilding Corporation at their Camden plant, many of the parts such as piston-rods, connecting-rods, piston-bearings, etc. being already machined, while the big castings such as cylinder-box, cylinders, bed-plate are in the machine shop and will shortly be on the machine-tools.

The upper part of the engine will follow Werkspoor design, which includes the cylinder-box, mushroom-cylinders with integral head; diagonal eccentric valve reversing mechanism, with the long strutted-rods for operating the single camshaft, offset-fuel-valves, and detachable cylinder extensions. The bed-plate will be of similar but heavier construction.

However, the long steel columns and diagonal tie-rods so familiar to Werkspoor practice have been replaced by cast-iron frames which run from steel tie-rods running from the top of the cylinder-box to the bed-plate. There are also steel tie-rods running from the top of the cylinder-box down to the underside of the bed-plate. As forced lubrication is being used, the spaces between the frames will be enclosed by removable metal-plates allowing easy access. The New York designers favor the cast-iron frame and the steel column construction equally well from an engineering standpoint but consider the frames perhaps better conform to American merchant-marine practice.

NAMES OF MOTORSHIPS FOR TANKERS LTD.

The names of the four Diesel-driven 10,050 tons d.w.c. tankers now building by Vickers, Ltd., for Tankers, Ltd., are "Scottish Standard," "Scottish Maiden," "Scottish Minstrel" and "Scottish Musician."



General arrangements of the New York-Werkspoor Diesel marine-engine now under construction at the New York Shipbuilding Corporation's plant at Camden, N. J. Some minor modifications not shown on the drawing are being made

New Nobel 2,000 i.h.p. Diesel Marine Engine

First Details of Slow-speed Two-cycle Single-acting Crosshead Engine Which Shows Considerable Saving in Weight and Space Over Other Designs, with Fuel-consumption as Low as Leading Four-cycle Diesel Engines

By* EDVIN LUNDGREN, M.E.

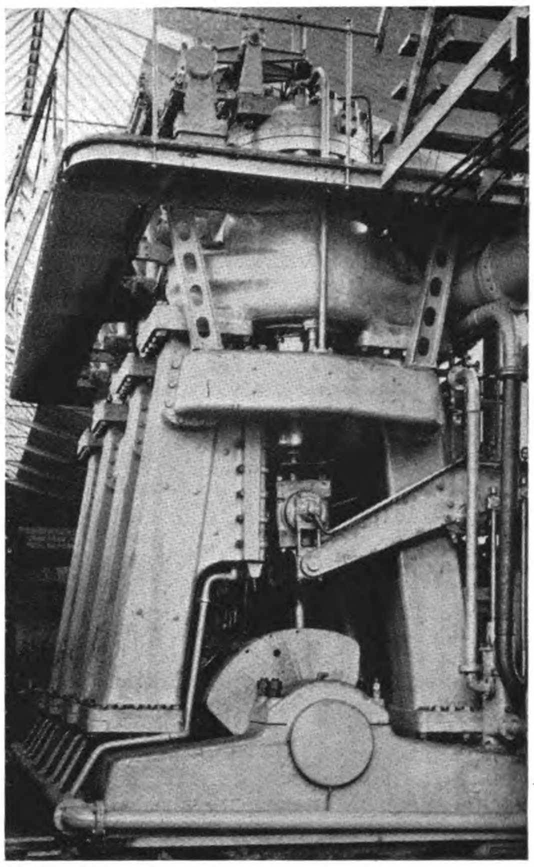
IN these days, when engineering and technical science have reached such a high degree of perfection, the opinion is often expressed that a stage has now been reached where further development along many lines is hardly possible or that further advances are comparatively unimportant. Indeed it must be admitted that progress in most branches really is of less magnitude than formerly, and it is also recognized that each step forward now requires considerably more headwork and study than in former times. And yet, every day we witness some advances in nearly every line, sometimes very striking advances, embodying new ideas, often of an almost freaky nature, sometimes the improvements are hardly perceivable to the superficial observer.

Also the Diesel-engine has during the last few years shown some remarkable progress and development. Some of this progress involved more radical changes and daring features, like for instance the English opposed-piston engines and the various airless-injection engines. Others have worked along more conservative lines, concentrating their efforts to improve the efficiency of existing elements and principles.

Among this latter group the new Nobel-Diesel engine may be classed, although it also shows a number of distinctly original and ingenious new features, the majority of which are covered by patents. The designers of this engine desired in the first place to produce a perfectly reliable and mechanically simple engine which should attain the highest degree of economy. Besides their aim was an engine which occupied a minimum of space for its power and the weight of which was to be kept within very reasonable limits.

Now, the first question which has to be decided upon by any designer who is to construct a new engine concerns the fundamental working principle. Is the engine to work according to the 2-stroke or the 4-stroke cycle? The issue is an old one and has been discussed over and over again, so it sometimes may seem tiresome to treat the subject once more, and yet every Diesel-engine builder must from time to time reconsider the question, face it squarely and decide for the one or the other.

Theoretically, no doubt, the 2-cycle is superior, as will be admitted by all who have studied the matter. In practice the inherent advantages of the 2-cycle are not always attained. As often pointed out, the difficulties to be overcome in designing a 2-cycle engine are far greater and require more experience and engineering skill than the comporatively simple 4-cycle problem. The Nobel-Diesel Company had the advantage of an extensive experience with both the 4-cycle as the 2-cycle, but has come to the firm conviction that the latter is decidedly superior and that it offers the greatest possibilities for the future, especially for the larger sizes.



End view of Nobel engine showing heavy cast-iron A-type columns and balance weight on crankshaft

The new Nobel-Diesel engine is therefore a 2-cycle engine, and without enumerating all the well-known theoretical advantages of the 2-cycle and discussing their value, it shall here merely be referred to the actual performance of the engine which plainly proves that all these theoretical advantages can fully be obtained by a rational and scientfic design.

The most outstanding feats and features of the engine may be summed up as follows:

Rating, Speed and Weight: With a rated capacity of 1,600 brake horse-power or 2,000 indicated horse-power at a speed of 106 revolutions per minute this Nobel-Diesel engine weighs, including a 13-ton flywheel, scavenging pumps, air-compressors, etc., but *170 tons or 236 lbs.* per B.H.P.

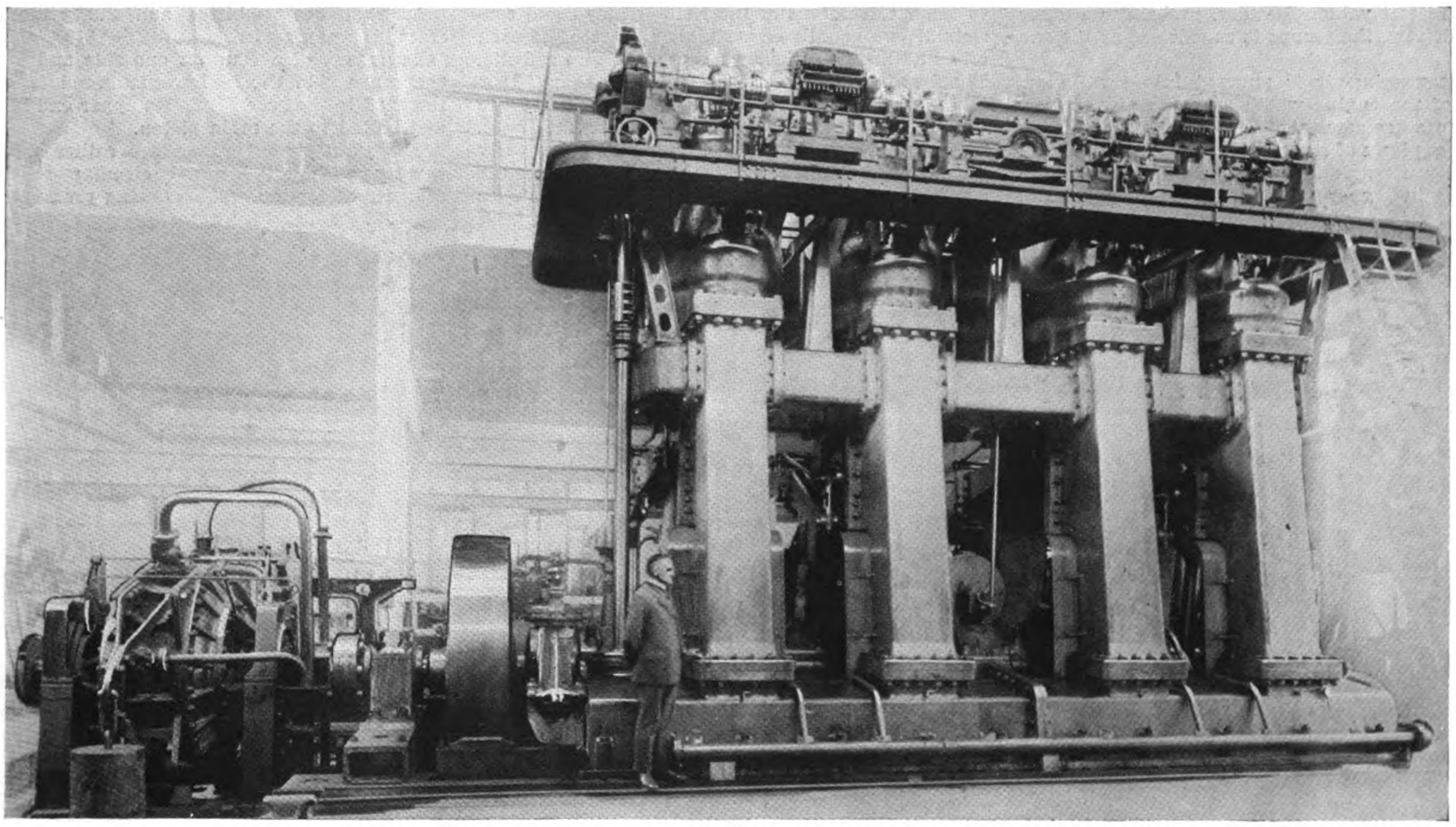
Overall Dimensions: The total length of the engine is 7.8 meters or 25 ft. 7 in.; its height above the center of the shaft to the top of the fuel value is 5.9 m. or 19 ft. 4 in. The meaning of these figures will be fully realized by a glance at the illustration, showing in shaded lines the contours of the Nobel-Diesel engine in comparison to a 4-cycle engine of a very prominent make, which is developing approximately the same power at the same speed.

Fuel Consumption: At full-load the fuel-consumption of the engine is *0.395* lb. of oil per B.H.P. hour with a heating value of 9,960 calories per kg. or *17,900 B.T.U.* per lb. That is exactly as favorable as the fuel-consumption of a good 4-cycle engine. At lighter loads the fuel consumption of this engine is considerably less than that of any 4-cycle engine.

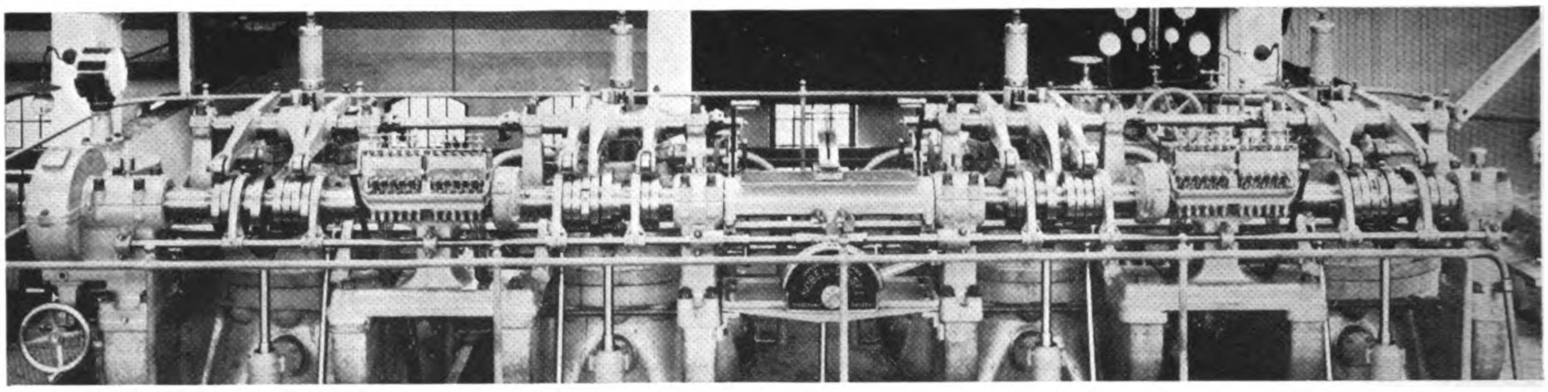
Mean-Indicated Pressure: At the rated load the M.I.P. is 6.48 at or 92 lbs.

Mechanical Efficiency: At full load the mechanical efficiency is *81%*. At 10% overload the mechanical efficiency is *82.3%*.

Overload Capacity: The heaviest overload so



General view of 2,000 i.h.p. Nobel two-cycle type Diesel marine engine on test bed showing Froude dynamometers used for recording power tests



View of valve gear and operating platform of Nobel marine engine

far carried is 22%, the engine developing 1,958 B.H.P. at 108 r.p.m. continuously during a period of ¾ of an hour without any trouble whatever.

The accompanying test chart of the official tests reveal further data of general interest to be referred to later.

The *fundamental working principle* of the engine is that of the ordinary 2-cycle engine with scavenging-ports in the cylinder walls and with scavenging-pumps, except that the scavenging-air is controlled by valves. Moreover, the scavenging-ports possess a greater height than the exhaust-ports in order to make supercharging possible.

As will be seen from the various illustrations, the mechanical construction is principally following conservative standard marine practice. The open A-frames with the one-sided cross-head slipper, the manner in which the frames are bolted to the bedplate as well as to the cylinders, the links and rocker-arms which serve to actuate the scavenging-pumps, the air-compressors and circulating-pumps, all these details and, in general, the convenient accessibility, so valued by marine engineers, remind one of standard marine steam-engine construction.

General Arrangement: The engine has four working-cylinders, each resting upon the two cast-iron columns composing one A-frame. Rocker-arms, connected to the crossheads, drive in the following order, the combined low and high pressure stages of the injection-air compressor, the two scavenging-pumps and the intermediate stage of the air-compressor. All this machinery is supported by brackets fastened to the bedplate directly opposite to the frames. This arrangement was chosen, as it, in the first place, utilizes the available space in the best manner, particularly in the longitudinal direction of the ship which is of the greatest value. Besides, probably no other way of driving the pumps is as efficient as the one used.

The scavenging-air is pumped into the hollow frames of the engine which serve as air-receiver. The frames are connected to each other by means of distance pieces of sufficiently large cross section.

The operating platform is arranged near the top of the engine, where all vital parts for operating and maneuvering are within easy reach of the engineer. If it should be preferred to have the operators stand on the main floor, no doubt this could be accomplished, but would require some additional and more or less complicated gearing.

Main Dimensions:

Working Cylinders:	
Diameter	675 m.m. (26.574 in.)
Stroke	920 m.m. (36.200 in.)
Scavenging-Air Pumps, double-acting:	
Diameter	920 m.m. (36¼ in.)
Stroke	680 m.m. (26¾ in.)
Diameter of plunger guide	200 m.m. (7⅞ in.)
Air-Compressor:	
Diameters of the three stages	540, 250 and 110 m.m. (22¼ in., 9⅞in. and 4 5/16in.)
Stroke for all three stages	570 m.m. (22½ in.)
Water Pumps, single-acting:	
2 pumps for cooling cylinders, etc:	
Diameter x Stroke	125 x 360 m.m (5 in. x 14 in.)
2 pumps for general service, bilge, etc.:	
Diameter x Stroke	125 x 360 m.m. (5 in. x 14 in.)
Circulating pump for pistons	
Diameter x Stroke	125 x 160 m.m. (5 in. x 6¼ in.)
Crank-Pin:	
Diameter x Length	400 x 480 m.m. (15¾ in. x 19 in.)
Main-Bearing:	
Diameter x Length of Journal	400 x 690 m.m. (15¾ in. x 27¼ in.)

Turning now to the mechanical details of the construction, we find the engine resting on a solid *cast-iron bedplate* composed of two sections, firmly bolted to each other. The bedplate is completely closed-in at the bottom, in order to collect the used lubricating-oil which is to be filtered and used over again. The main-bearings are of the customary type for Diesel-engines and provided with babbitted bearing-shells, which may be removed from their seat by turning them around the crankshaft. The lubrication of the bearings is accomplished by gravity feed, instead of by forced lubrication, as is the standard practice in America.

The crank-shaft, weighing approximately 13 ton, is like all the other details made to conform to the specifications of the British Lloyd and consists of two equal parts, rigidly connected to each other by means of heavy flanges and strong bolts. The first two cranks are placed at an angle of 180° to each other, the following two also at 180° to each other but at an angle of 90° to the first ones. The engine is well balanced by means of properly dimensioned counterweights, bolted to some of the crank-arms. Any free forces or rocking couples are thereby reduced to a minimum. The lubrication of the crank-pin is effected by centrifugal rings. On account of the arrangement of the cranks the ignition in the cylinders takes place in the following order, 1, 3, 2, 4, and the turning effort is quite uniform, but a fly-wheel, weighing 13 tons and having a diameter of 2,500 MM. (8 ft. 3 in.)., serves to make the rotating speed still more uniform. The fly-wheel is figured for a speed fluctuation coefficient of 1/30.

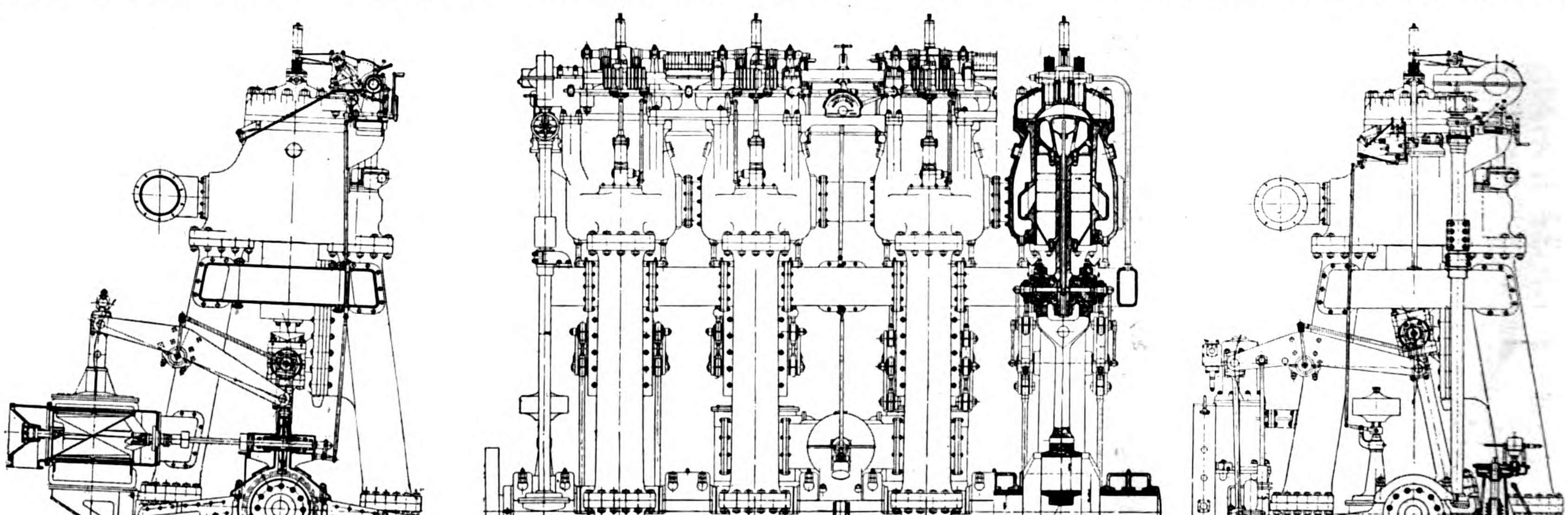
On the rear end of the crank-shaft, between the fly-wheel and the end main-bearing of the engine, a fairly large worm-gear is mounted for the purpose of slowly turning or "barring" the engine. The worm meshing with the gear is supported on a slide which by means of a handle can be moved easily, thus throwing in or disengaging the worm at will. The wormshaft is driven by a pair of spur-gears from an ordinary small pneumatic motor as commonly used for drill tools.

The connecting-rods are of standard design and made of open-hearth steel with a tensile strength of 70,000 lbs. per sq. inch and an elongation of 33%. The lower heads consist of two symmetrical steel castings with babbit lining and are held together by a solid-steel strap and two bolts. The upper ends are of the forked type but otherwise of similar design as the lower head. The forked type was chosen as with the same the piston can be brought closer to the crosshead, which contributes to reduce the height of the engine.

The cross-head consists of two separate main parts, the central piece, the two ends of which form the crosshead-pin, and the cast-steel shoe, which is bolted to the central piece. The cross-head shoe is guided between the main sliding-surface fastened to the A-frame and the guide-bars on either side. The wearing surfaces of the cross-head shoe are babbitted and the guide on the frame is water-cooled.

By means of a cone on one side and a nut on the other side the hollow piston-rod is securely fastened to the crosshead. Its upper end is flanged and bolted to the main piston.

The main piston proper is a rather short iron-casting with an internal circular rib to the crowned piston-top. The working pressure is thus



Sectional view showing arrangement of operating scavenging pumps and rotary valve; longitudinal elevation and section through cylinder; end view showing vertical shaft operating camshaft drawings of the Nobel 2,000 i.h.p. Diesel marine-engine

transferred in the most direct way to the piston-rod. Below the proper piston a light cast-iron sleeve is attached to another flange on the piston-rod. The only object of this piston sleeve is to keep the ports in the cylinder walls covered during the upward stroke of the piston. On its downward stroke this sleeve extrudes almost entirely out of the cylinder so that its surfaces may conveniently be inspected with regard to lubrication.

Through swinging-pipes the cooling-water is admitted to the central hole in the crosshead, whence it travels through the piston-rod to the piston and returns through a pipe in the interior of the piston-rod, to be carried away by swinging-pipes from the opposite end of the crosshead pin. The arrangement is as simple as it can be and perfectly reliable; not a drop of water can leak out, and consequently salt-water can be used without any risk of spoiling the lubricating-oil.

The most vital part of the engine is the cylinder, as it "embodies the lungs of the engine," namely the arrangements for exhausting and scavenging. The inner liner is made of special close-grained cast-iron and with a mild shrink-fit inserted into the outer jacket. The parts of the liner surrounding the exhaust-ports are provided with drilled vertical holes in order to secure a most effective water cooling. The exhaust-pipe, connecting all four cylinders, is of course also water cooled. An extension to the cylinder on the opposite side carries the piston-valve which prevents the exhaust-gases entering here and which controls the scavenging-air. This valve is actuated by a pushrod from a cam on the layshaft above. The scavenging-air enters from below, leaving the hollow *frame casting* which as already mentioned serves as air-receiver. The frame castings are otherwise very simple castings which transfer the stresses from the bedplate to the cylinder in the most direct and straightest way. There are a number of patented features about the cylinder, one of the mcovering a remarkably simple, but very efficient, method of cooling the upper joint between liner and water jacket. This joint is exposed to the very high internal-combustion heat and its cooling is therefore in all Diesel-engines of great importance, but possibly particularly so in 2-cycle engines where the amount of heat to be carried away is larger than in a 4-cycle of the same dimensions.

The cylinder head is an extremely simple and perfectly symmetrical steel casting, provided with ample water spaces. The reliability and safety of simple castings are too well known to builders and users of Diesel-engines to be discussed further. In its center the cover carries a *fuel-valve* of standard design, on one side the *air starting-valve* is arranged; on the other side is the compression relief-valve, which is combined with the safety-valve, and which relieves the compression in order to facilitate starting. The air which during starting is compressed in the working cylinders is not permitted to go to waste, but escapes into the air receiver and intermingles with the scavenging-air. This addition to the scavenging-air is very valuable, especially since it takes place in the beginning of the operation, before the scavenging pumps have been able to fill the receiver with air of the required pressure. On this account there is absolutely no trouble met in starting the engine. Even if the engine is perfectly cold, it can at any time be started within a few seconds, although the air pressure may be as low as 100 lbs. sq. inch. In order to prove this and also to determine the amount of air consumed for starting, a series of tests was conducted, the results of two of which are as follows:

	Test n:r 1	Test n:r 2
Volume of air tank	2 cbmeter. (70.6 cubic feet)	
Barometric pressure	753 m.m. Hg.	770 m.m. Hg.
Condition of engine	cold	cold
Temperature in engine-room	19°C. (66°F.)	13°C. (55°F.)
Air-pressure in tank before starting	21.3 at 304 lbs.	7 at 99.6 lbs.
Air-pressure in tank after starting	18.7 at 267 lbs.	5 at 71.2 lbs.
Pressure-drop during starting	2.6 at 37 lbs.	2 at 28.4 lbs.
Air consumption reduced to atmospheric pressure	5.2 cbm. (183 cub. ft.	4 cbm. (141 cub. ft.)
Time used for starting	2½ seconds	6 seconds
Number of cylinders, to which starting air was admitted	2	4

As indicated above, easy starting is made possible by relieving the compression and thereby decreasing the initial resistance, and also because, as soon as the relief-valve is kept closed, the cylinder is filled with sufficient air to insure a high compression and with it a regular ignition. This point has been dwelt upon explicitly, as it often has been stated that some 2-cycle engines have to be heated before starting. A similar statement has for instance been made by J. Anderson in the transactions of the American Society of Mechanical Engineers with regard to the U.S.S. "Maumee."

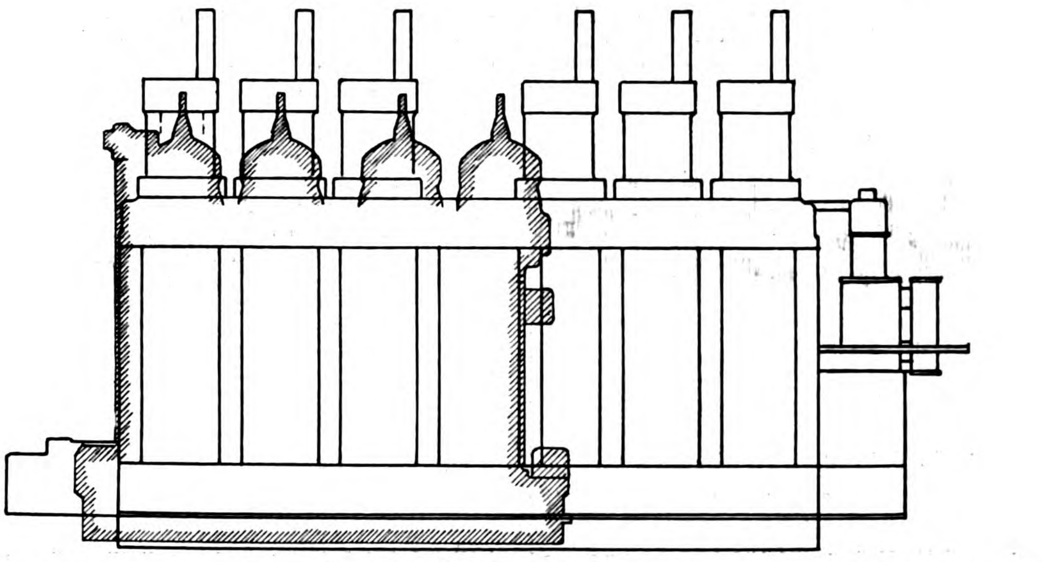
Valve-gear.—All valves are actuated by means of cast-steel rocker-arms, the fulcrum of which is formed by eccentric shafts, one for each cylinder supported in bearings fastened on the cylinder-heads. These eccentric shafts are flexibly connected in pairs, each pair can be turned by means of a lever, conveniently arranged near the center of the engine and provided with a latch which locks the lever in one of the three positions determined by notches on a segment. Thus by turning the lever either the rollers of the starting and the relief-valves or the roller of the fuel valve are brought into contact with their corresponding cams or both are brought into a neutral position entirely out of reach of these cams. For each valve there are two cams, one for ahead, the other one for astern. All cams are keyed to sleeves which by means of a rod with fingers or forks can be shifted on the cam-shaft. At the first glance the whole arrangement may look somewhat complicated, but it is to be remembered that normally during actual service only one cam and one valve, namely, the fuel valve, is active.

It will be observed that the camshaft is driven by means of an intermediate vertical-shaft and two sets of spiral gears. From this vertical shaft also the fuel-pump or rather the four fuel-pumps which are united in one casting are driven by one single eccentric. If desired, however, this drive can be disengaged and the fuel-pumps may be driven by hand as for instance in order to fill the piping with oil before starting. The amount of fuel delivered to each cylinder is as usual in Diesel engines controlled by lifting the suction-valves of the pumps. This is either accomplished by hand, by means of a system of levers and rods, or automatically by the action of a Jahns centrifugal governor, which cuts off the fuel supply entirely as soon as the engine obtains a speed of 130 r.p.m. and thus prevents racing. This governor is located just opposite to the vertical shaft and is driven by a set of spiral gears from the crankshaft.

The rocker-arms which drive the scavenging-pumps and the air-compressor have been designed with the view of facilitating easy and exact adjustment and assembling. Any undesirable play that continuous wear may be liable to produce can easily be taken up.

The proper arrangement and design of the scavenging-pumps are of the highest importance for the efficiency of the whole engine. Also this construction is guarded by a number of patents. The pumps are double-acting. The valve-gearing is of a remarkable simplicity, as there is only one single rotary-valve for both suction and pressure of both ends of both scavenge pumps. This valve is located in the center of the engine length transversely to the crank-shaft from which it receives its motion by means of a pair of spiral gears. It runs with only one-third of the engine speed and is therefore consuming but a slight amount of power.

Besides the pressure of the scavenging-air is kept exceedingly low; at full load and full speed it only amounts to 1.6 lbs. sq. inch. All these factors contribute to reduce the work expended for



Comparison of the Nobel 2,000 i.h.p. (1,600 shaft h.p.) at 106 r.p.m. with standardized four-cycle Diesel marine engine of the same power and speed

No of Test		1	2	3	4	x)6	7	8	9	10	11	12	12a	12b	12c	13	14	x) Test No 5 was intended
Date		23/8 10.30-3.45 continual run					24/8 3.0-5.30			10/9 3.00 an. — 11/9 3.04 an. continual run 24 hours.							19/9	to be made with P=3000 kgs
Revs pr min.	n	87,3	84,7	85,0	82,4	64,3	65,2	65,9	45,2	106,6	106,0	107,0	105,3	105,8	105,4	105,1	108,4	and n=65, but the brake-
Brake load kg	P	1669	2060	2612	2999	2600	2062	1578	1492	1600	2100	2750	2750	2750	2750	3000	3250	load could on account of
Brake-horsepower 75 kgm/sek	N_e	810	970	1232	1456	930	746	578	375	948	1237	1635	1610	1615	1612	1752	1958	the brake be only 2600 kgs
Eff. meanpressure kg/cm²	p_e	3,18	3,92	4,98	5,72	4,95	3,92	3,01	2,84	3,05	4,00	5,23	5,23	5,23	5,23	5,72	6,20	at this speed test No 5 thus
Working cylinders: Ind meanpressure kg/cm²	p_i	4,45	5,20	6,38	6,98	6,07	5,09	4,00	3,83	4,30	5,24	6,47	—	—	6,48	6,94	7,58	being eliminated.
Working cylinders: Ind horsepower	N_i	1137	1290	1582	1797	1142	970	770	496	1342	1623	2022	—	—	2000	2128	2401	
No load	N_i-N_e	327	320	350	341	212	224	192	121	394	386	387	—	—	388	376	443	
Mechanical efficiency $\frac{N_e}{N_i}$	η_m%	71,3	75,2	77,8	81,2	81,4	76,9	75,0	75,4	70,6	76,2	81,0	—	—	80,5	82,3	81,7	
" " $\frac{N_e}{N_i-(N_{isp}+N_{ik})}$	η_m%	81,4	84,1	85,8	89,5	89,9	86,4	85,5	86,4	81,1	85,5	89,2	—	—	—	90,2	89,5	
Thermic "	η_{th}%	48,4	46,0	44,6	42,2	42,8	45,9	46,3	44,5	47,6	45,6	42,7	—	—	43,8	42,1	40,6	
Thermodyn. " $\eta_e=\eta_m\cdot\eta_{th}$	η_e%	34,4	34,5	34,7	34,2	34,9	35,3	34,6	33,7	33,7	34,7	34,6	35,2	35,5	35,4	34,8	33,1	
Fuel consumption pr hour kg	G	149	178	225	270	169	134	105,6	70,8	179	226,6	300	290	288,6	289	320	375	
Fuel pr ind. HP-hour gr.	g_i	131,1	138,0	142,2	150,8	148,2	138,2	136,9	142,4	133,2	139,6	148,2	—	—	144,5	150,3	156	
Fuel pr BHP-hour gr.	g_e	184	183,6	182,6	185,5	182,0	179,6	182,8	188,0	188,0	183,0	183,7	180,0	178,5	179,0	182,5	191,4	
Scav. pumps: Ind meanpressure	p_{isp}	0,155	0,150	0,155	0,160	0,100	0,110	0,100	0,066	0,180	0,180	0,180	—	—	—	0,175	0,190	
Scav. pumps: Ind horsepower	N_{isp}	52,8	49,6	52,4	55,6	25,3	27,6	25,3	11,7	75,3	74,9	76,0	—	—	—	72,3	81,5	General remarks.
Air-compresser: Pressure	E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Length of Brake-arm=3987
Air-compresser: Meanpressure	p_{ik}	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	[illegible]	—	Brake horsepower $N_e=\frac{Pn}{180}$ HP
Air-compresser: Horsepower	N_{ik}	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	[illegible]	—	Test No: 1-13 / 14
Air-compresser: Total Horsepower	ΣN_{ik}	80,6	85,7	94,4	100,2	71,6	79,7	69,1	50,9	98,8	101,3	111,9	—	—	—	114,8	133,7	Fuel: Galisol / Texaloil
Scav air-pressure m/m water	sp	830	825	850	950	510	500	540	320	1100	1100	1145	1120	1120	1110	1115	1280	Sp. gravity 0.86 / 0.855
Temperature of exhaustgases C°	$T°$	188	224	275	318	260	195	163	136	201	244	315	309	307	306	334	352	Lower cal. value cal. per kg. 9960 / 9990
" " inlet air	t_s	21	23	24	22,5	22	22	21	21	19	18,5	18	17	17	17,5	18,5	14	Flash-point +74°C / +72°C
" in airreceiver	t_{sp}	30	32	33	32	27	26	26	25	32	31	31	30	30	30	31	27	
" of water inlet		18	18	18	18	18	18,5	19	—	14,5	14,5	14	14	14	14	14	—	
" " " outlet fr. pistons		30	33	39	41,5	34	30	27	28,5	26	28	32	32	32	32	32	—	
" " " " " cylinders		26	28	31	33	34	30	28	29	24	25	28	28	28	28	28	—	
" " " " common		—	—	—	—	—	30	29	30	25	27	30	30	30	30	30	—	

Official test of Nobel engine made under supervision of A. Rosborg of Stockholm

the scavenging pumps to a minimum. At full load and normal speed it amounts to only 3.5% of the total indicated horse-power of the engine. Such a low figure can hardly be obtained with an independent drive of the scavenging-pumps, so appealing and simple this manner of driving at the first glance may appear.

Another advantage of the low-pressure is that artificial cooling of the air can be dispensed with, the rise of temperature at full load only amounting to 10-12° C. or 18-21° F.

The necessary air for the fuel-injection is furnished by the three-stage compressor of which the low and high pressure stages are combined in one casting, while the intermediate-stage cylinder is located separately at the other end of the engine. The valves are of the standard Nobel design with simple steel disks which have shown their reliability since a large number of years. All compressor cylinders are provided with safety-valves of sufficient sizes.

Lubrication of the compressors as well of the working cylinders, crosshead-guides and crosshead pins is effected by the two lubricating-pumps with sight feed.

Cooling water is furnished by several pumps driven from the rocker arms: Two circulating pumps deliver water to the cylinders, one separate pump supplies the pistons with cooling-water and besides there are two pumps for general purposes, *i. e.*, bilge-pump, etc.

After all important mechanical details have been touched upon, a few remarks about the operation and maneuvering of the engine may be of interest. Following the natural order, the first operation to be described is:

Starting.—After having made sure that the fuel piping is filled with oil and that there is sufficient compressed-air in the air-tank, the operator turns the above mentioned eccentric-fulcrum shafts by means of the turning levers into the starting position. As explained before, thereby the rollers of the starting valve and of the relief valve are brought into contact with their corresponding cams and at least one of the starting-valves will immediately open and admit air to its cylinder. The air pressure sets the engine into motion, and after one or two revolutions, as soon as the engine has received sufficient momentum, the engineer throws the turning levers into the normal running position which sets the starting and the relief-valves idle and puts the fuel valve into service. Regular ignitions occur immediately. The starting is normally accomplished within two or three seconds.

As a minor detail although causing considerable convenience a separate air-valve may be mentioned which is placed near the turning lever and controls the air supply, opening only when the operating lever is shifted into starting position, and automatically and reliably shutting-off the air as soon as this lever is moved over into the neutral or the normal running position. This arrangement prevents air losses in case the starting-valve may leak, which easily may occur during continuous or frequent maneuvering.

Speed Control.—During service the engine speed is controlled by the little lever in front of the operator. This lever moves in a slot, the edges of which are graduated and influences the fuel supply by acting upon the suction-valves of the fuel-pumps. In this way the engine can be slowed down as far as you please. On the test-bed the engine has been running for hours at a speed of 28 revolutions per minute, without showing the slightest irregularity or missing a single ignition in any of the four cylinders. The compression in the cylinder is at this speed 27 atmos (38.5 lbs) and the pressure in the scavenging-air receiver but 0.21 lb. The pressure of the injection-air at this speed is 30 atmos (430 lbs.), that is only slightly higher than the compression in the cylinder. It may be added that at normal speed the compression is 430 lbs., the scavenging pressure 1.6 lbs. and the injection-air pressure 60 atmos (860 lbs.).

It is even possible to stop the engine entirely by the small speed regulating lever, but it is preferred to move the turning levers of the eccentric valve shafts into neutral position whereby the fuel-pumps are cut out automatically.

Reversing.—Suppose now, the engine is running full-speed ahead, suddenly the signal is given: Full speed astern! The engineer then throws the two turning levers into their neutral position, turns thereafter the reversing lever from the ahead position at the right to the astern position to the left. He then starts the engine again as described above, and the engine will run in the opposite direction. The reversing is easily accomplished within eight seconds without any considerable effort by the engineer.

The most remarkable and appealing feature is that it is accomplished merely manually, without any servomotor or outside source of power.

It requires more than eight seconds to explain what is occurring when the engineer acts as ust described: First, by bringing the eccentric-shafts into neutral position, the fuel-valves are put out of motion and the fuel-pumps are cut-out; thereby the engine is brought to a standstill after a few revolutions. By turning the reversing lever, in the first place, by means of a gear segment and a rack, the camshifting rod is moved which in its turn brings the cams for the reverse rotation into their proper position. Simultaneously, by a system of levers and rods, the scavenging-air controlling valves are brought into their correct position for the reverse, whereupon the starting can be effected in the usual way.

The various levers are mechanically interlocked, so that it is impossible to move the reversinglever and shifting-rod, unless both eccentric turning levers are in their neutral position and on the other hand none of these levers can be moved, unless the reversing-levers and with it the other parts, cams and valves are in their proper position either for forward or for astern running.

Official Tests.—Under the supervision and control of Professor A. Rosborg of the Technical University of Stockholm a series of very thorough tests were conducted during August and September of this year. The principal results of these tests are compiled in the accompanying test chart, which gives some very valuable information and data. Information of this kind is seldom to be had, as most manufacturers prefer to keep it for themselves, and I wish at this occasion to thank the Nobel-Diesel Company for allowing me to use this material for publicity. I am convinced that it will be appreciated by all who are interested in the progress and development of the Diesel-engine.

During the tests the brake-load was furnished by a Heenan & Froude hydraulic brake n:r LS 11. The brake-lever was 3,987 mm. long and if P is the weight at the end of this lever and N the number of revolutions per minute, the brake horse-power in metric horsepower is Ne $\frac{Pn}{180}$. Brake and weights were of course carefully checked.

Engine-speed was measured by tachometers as well as by ordinary revolution counters, from the readings of which the exact number of revolutions per minute during each test were computed. Indicator cards were taken of all working-cylinders and also of the scavenging air-pumps and the air-compressors. Pressure on space prevents "Motorship" publishing a set of indicator-cards in this issue. All indicator-springs were carefully checked.

The fuel oil consumption was measured by placing the oil tank on a sensitive balance scale. The time during which a certain quantity, say 500, 100 or 200 kg., at a certain constant load was consumed, was exactly determined with a chronograph. The oil was sampled and its heating-value determined by the Government's testing station. Its effective heating-value was found to be 9,960 calories per kilogram of 17,900 B.T.U. Its flash point was 74° C. or 165° F. and its specific gravity 0.86.

The lubricating-oil consumption amounted during the tests only to 4.6 lbs. per 1,000 B.H.P. hour. It must be remembered, however, that the engine, like all new engines on the test bed, was freely oiled.

Further the temperatures of the incoming and the discharged scavenging air were measured, as also the temperatures of the cooling-water and of the exhaust gases. The latter were analyzed by an Orsat apparatus and their composition at full-load was found to be the following:

CO_2	4.75%
O	14.4 %
CO	0.1 %
N	80.75%
	100

The analysis thus indicated a good combustion which was confirmed by the appearance of the exhaust gases, the same being practically colorless at normal load and barely perceptible at overload.

To subject the engine to a thorough trial, at first a number of tests were made at various loads and speeds, thereafter a series of manoeuvering trials were carried out and finally the engine was run for 24 hours at full load and full speed. At the end of this run all parts were in excellent condition, the warmest bearing having a temperature of 45° C. or 113° F.

In the next issue "Motorship" will give some results of the tests in graphical form which, as usual, gives a clearer conception than tables.

Furthermore, some very interesting relations between power, fuel consumption, mechanical efficiency and the temperatures of the exhaust gases are shown. Special attention is called to the curves for the fuel consumption and the mechanical efficiency, not only on account of the absolute values but also as they strikingly demonstrate the extraordinarily high mechanical efficiency and the remarkably low fuel consumption of the engine at light loads. At half-load for instance the mechanical efficiency is above 70% and the fuel-consumption but 188 gram. B.H.P. or 0.42 lb. B.H.P. In this respect the engine is far superior to any 4-cycle engine. This condition makes also the engine very apt for certain stationary purposes where the engines often have to run under light loads. This superiority of the 2-cycle is ultimately founded in the fact that the working parts are utilized better than in a 4-cycle engine with its practically idle second revolution.

In conclusion the writer wishes to compliment the Nobel-Diesel Company upon its success and also upon its readiness to show and demonstrate the engine to all who are interested, even to competitors, which shows a high degree of quiet self-confidence. Finally the writer wishes to express his thanks and indebtedness to Director Ludwig Nobel and the company's chief-engineer, Mr. A. Lagersten, for their courtesy of placing all the above information and material at his disposal.

Nobel-Diesel High-Speed Engine of 1,320 Shaft H.P.

Details of the Motor Installed in Nine Russian Submarines

THE August number of "Motorship" contained an illustration of a big submarine engine built by the Nobel Works in Petrograd for the Russian Navy. This engine is remarkable for its size, as well as for a number of constructional details. As up to this time nothing has been published about this machine, a short description of the same might prove to be of general interest.

General Arrangement and Main Dimensions

Each submarine was provided with two engines with a capacity of 1,320 B.H.P. apiece at 350 r.p.m. Each engine consisted of eight working cylinders, two cylinder bushings or liners always being connected and inserted in a common water-jacket. The cylinders had a diameter of 390 mm. and the stroke was 430 mm. The engine worked on the two-cycle principle and the scavenging-air was admitted to the cylinder through ports in the cylinder walls and was controlled by a common piston-valve for each pair of cylinders.

Scavenging air was furnished by two double-acting scavenging-air pumps arranged ahead of the main cylinders and driven by cranks from the main shaft. The diameter of the pumps was 760 mm. and the stroke 430 mm. The upper parts of the scavenging-pumps formed the low pressure cylinder for the injection-air compressor, while the cylinders for the intermediate and the high-pressure stage were combined in one separate casting placed at the extreme end of the engine. Fuel-pumps, one for each cylinder, were arranged between the scavenging-pumps and the working-cylinders.

Constructional Details

The base plate was made of cast-iron, composed of three parts, entirely closed in the bottom, while the frame was of a comparatively light box-section, light because the working pressure was transferred from the main-bearings to the cylinders directly by means of heavy bolts, six

bolts for each pair of cylinders, the bolts in the joint between two adjacent cylinder pairs serving both pairs. As a rule this type of frame makes a light engine, but from a manufacturing standpoint it is usually less desirable, as it necessitates thin-walls and complicated castings. The material was cast-iron.

Also the cylinders were made of cast-iron, and in the beginning the cylinder covers likewise. As, however, during the war it was difficult to obtain good pig-iron and coke in Russia, the raw materials for cast iron, some trouble was experienced with the covers of which a good many cracked: they were then made of cast-steel which proved satisfactory. The cover carried the fuel valve, the starting valve and the safety valve.

Water cooling of the pistons was at first effected by a system of telescopic-pipes, but later replaced by swinging-pipes. In order to obtain light reciprocating weights, the connecting-rods were made of nickel steel, heat-treated and of I-section. The crank-shaft was also made of nickel steel; it consisted of three parts and had altogether 11 crank-throws. While the first two were furnished before the war by an Austrian concern, the remaining ones were furnished by Vickers Ltd. of England and delivered via Archangelsk.

The camshaft was arranged at about middle height of the engine and driven by means of two pairs of spiral-gears and an intermediate vertical shaft. The valves were actuated by pushrods.

Engine Control

Originally it was intended to make the engine reversible, but later this was not considered necessary for the submarine. The operating platform, not shown in the picture, was arranged slightly above the top of the frame. Starting and speed regulating was effected from the rear end of the engine, by means of a hand-wheel, levers and rods which in the customary way acted upon the eccentric-fulcrum shaft of the rocker-arms for the air and the fuel valves and upon the fuel-pumps.

Fuel Consumption

When the engine was running at 350 revs. per min., the fuel consumption was 228 grams per brake horse-power, at 250 R.P.M. it decreased to 210 grams. While the engine was not as economical as other Nobel engines and some of the details possibly not quite as fortunately worked-out as on other machines, the engine represented a remarkable piece of work and the highest class of workmanship. Material as well as the work was conforming to the exceedingly rigid specifications of the Russian Naval Authorities, who also exercised a very strict inspection.

Eighteen such engines were delivered, but their fate is unknown: some of them may rest peacefully on the bottom of the Baltic Sea; other engines may have been destroyed in some different way, like so many other fine pieces of human work during the war. This is of course a regrettable loss, but the experience gained while carrying out the work is not wasted but is now utilized by the Nobel-Diesel Company in Sweden for peaceful purposes.

List of German Motorships (Fishing and Pleasure Craft not Included) Building or Completed Since January 1, 1919

I Motorships Completed

No.	Name	Yard	Owner	Dimensions (m) Reg. Tons Gross D. W. Cargo Capacity	Number and Power of Engines Speed	Number and Dimensions (m-m) of Cylinders	Type of Engines	Maker of Engines	Remarks
1.	Zoppot	Germania Werft, Fr. Krupp, Kiel	Balt. Amerik. Petrol. Imp. Ges., Danzig	160. 24 x 20. 27 x 12. 57 9930 R. T. 15,700 tons	2 x1750 B.H.P. 10.75 knots	6 x 575/1000	Diesel, 2-cycle	Germaniawerft, Fr. Krupp, Kiel	Oil tanker.
2. 3.	Ostpreussen Oberschlesien	Germania Werft, Fr. Krupp, Kiel	Hugo Stinnes, Hamburg	84. 12 x 12. 35 x 7. 15 2083 R. T. 3000 tons	2 x 700 B. H. P. 10 knots	6 x 450/420	Diesel 4-cycle	Maschinenfabrik, Augsburg Nürnberg	Oil tankers. Each ship made out of two submarine hulls. Engines formerly destined for submarines.
4.	Adolf Sommerfeld (ex-Gefion)	F. Schichau, Danzig	Danziger Hochund Tiefban Ges., Danzig	105. 25 x 13. 14 x 8. 87 2146 R. T. 3200 tons	2 x 900 B.H.P. 9.5 knots	6 x 450/420	Diesel 4-cycle	Maschinenfabrik, Augsburg Nürnberg	Engines formerly destined for submarines.
5.	Havelland	Blohm & Voss, Hamburg	Hamburg Amerika Linie	136.70 x 17.68 x 9.00 6500 R. T. 10,200 tons	2 x 1950 B.H.P. 12 knots	10 x 530/530	Diesel 4-cycle	Maschinenfabrik, Augsburg Nürnberg	Engines formerly destined for submarines.
6.	Götaelf	Störwerft, Wewelsfleth	Baltische Reederei, Hamburg	56.0 x 8.64 x 4.60 .... 800 tons	2 x 410 B.H.P. 9.5 knots	4 x 340/560	Diesel 2-cycle	Gebr. Sulzer, Mannheim	Ferro concrete hull.
7.	Erna David	Fleusburger Schiffsbau Gesellschaft	Leopold David, Berlin	56.59 x 7.33 x 5.59 588 R. T. 850 tons	2 x 300 B.H.P. 12 knots	6 x 350/350	Diesel 4-cycle	Vulkan Werke, Hamburg	
8.	Kosmos, I	Hansa, A. G., Töuning	Kruels & Mais, Hamburg	56.55 x 7.70 x 5.49 623 R. T. 900 tons	2 x 300 B.H.P. 12 knots	6 x 350/350	Diesel 4-cycle	Vulkan Werke, Hamburg	Hulls built for torpedo-boats, shortened and reconstructed. Engines built for submarines.
9.	Leopold David	H. C. Stülken, Hamburg	Leopold David Berlin	56.10 x 7.70 x 5.49 620 R. T. 900 tons	2 x 300 B.H.P. 12 knots	6 x 350/350	Diesel 4-cycle	Vulkan Werke, Hamburg	
10.	Wilbo	Hansa, A. G. Töuning	Wilhelm Boelster, Hamburg	56.10 x 7.70 x 5.49 623 R. T. 900 tons	2 x 300 B.H.P. 12 knots	6 x 350/350	Diesel 4-cycle	Vulkan Werke, Hamburg	
11. 12.	Hausdorf Hoisdorf	Howaldswerke A. G. Kiel	Baltische Reederei Hamburg	71.79 x 9.13 x 5.40 980 R. T. 1400 tons	1 x 410 B.H.P. 8.5 knots	4 x 340/540	Diesel 2-cycle	Gebr. Sulzer Ludwigshaven	Hulls built for mine-sweepers, heightened and reconstructed.
13.	Seewolf (ex Hyäne)	Reconstructed Ver. Elbe u. Norderwerft, Hamburg	Cuxhaven, Bruisbüttel Dampfer, A. G. Cuxhaven	43.54 x 7.65 x 4.10 352 R. T. 450 tons	1 x 225 B.H.P.	6 x 300/300	Diesel 4-cycle	Benz u. Co. Mannheim	Ship formerly naval vessel.
14.	Odin	Reconstructed Deutsche Werke Wilhelmshaven	Arnold Bernstein, Hamburg	79.10 x 15.45 x 6.00 1590 R. T. 2100 tons	2 x 260 B.H.P. 9 knots	6 x 350/350	Diesel 4 cycle	Maschinenfabrik, Augsburg Nürnberg	Ship formerly coastwise battleship. Engines built for submarines.

II Motorships Building

No.	Name	Yard	Owner	Dimensions (m) Reg. Tons Gross D. W. Cargo Capacity	Number and Power of Engines Speed	Number and Dimensions (m-m) of Cylinders	Type of Engines	Maker of Engines	Remarks
15. 16.	Rheinland	Blohm & Voss, Hamburg	Hamburg Amerika Linie	136.70 x 17.68 x 9.00 6500 B. R. T. 10,000 tons	2 x 1750 B.H.P. 12 knots	6 x 720/1300	Diesel 2-cycle	Blohm & Voss Hamburg	
17.	....	Reiherstieg Schiffswerfte, Hamburg	Hamburg Südamerikan, D. G., Hamburg	....	2 x 2600 B.H.P.	....	Diesel 2-cycle	Gebr. Sulzer, Luwigshaven	
18. 19. 20.	....	Deutsche Werft Hamburg	Hamburg Amerika Linie, Hamburg	121.4 x 16.45 x 11.67 4500 R. T. 8000 tons	2 x 1160 B.H.P. 11 knots	6 x 630/960	Diesel 4-cycle	....	
21. 22.	....	Deutsche Werft Hamburg	....	114.3 x 15.70 x 8.63 3500 R. T. 6500 tons	2 x 1160 B.H.P. 11.5 knots	6 x 630/960	Diesel 4-cycle	....	
23. 24. 25.	....	Deutsche Werft Hamburg Deutsche Werft	....	.... 2800 R. T. 5500 tons	2 x 1160 B.H.P. 12 knots	6 x 630/960	Diesel 4-cycle	....	
26. 27.	....	Deutsche Werft Hamburg	Schindler Mineral Oil Works Hamburg	94 x 13.0 x 8.0 2300 R. T. 4000 tons	2 x 1160 B.H.P. 12 knots	6 x 630/960	Diesel 4-cycle	....	Tankers.
28. 29.	....	Deutsche Werft Hamburg	D. D. S. G. Kosmos, Hamburg	121.4 x 16.45 x 11.67 4500 R. T. 8000 tons	2 x 1700 B.H.P.	......	Diesel 4-cycle	Deutsche Oil Maschrnen Ges.	
30.	Behrentels	T. C. Tecklenborg, Geestemunde	D. D. S. G. Hansa, Bremen	.... 6200 R. T. 9000 tons	2 x 1600 B.H.P. 12 knots	......	......	....	
31.	....	Howaldtwerke, Kiel	D. D. S. G. Hansa, Bremen	.... 6200 R. T. 9000 tons	2 x 1600 B.H.P. 12 knots	......	Diesel 2-cycle	Sulzer Freres Luwigshaven	
32.	....	A. G. Weser, Bremen	....	131.0 x 17.15 x 10.01 6200 R. T. 9000 tons	2 x 1600 B.H.P. 12 knots	6 x 700/1200	Diesel 4-cycle	Maschinenfabrik, Augsburg, Nürnberg and A. G. Weser	
33.	....	Vulcan Co. Stettin	Norddeutsche Lloyd Bremen	6,300 D. W. T.	1 x 1,800 B. H. P. 12 knots	......	Diesel 4-cycle	Vulcan Co. Hamburg	

III Motor Sailing Vessels Completed

1. Magdalene Vinnen	Germaniawerft, Fr. Krupp, Kiel	F. A. Vinnen, Bremen	97.90 x 14.60 x 8.72 3200 R. T. 5200 tons	1 x 500 e.H.P. 6 knots	4 x 575/1000	Diesel 4-cycle	Germaniawerft, Fr. Krupp, Kiel	Four masted full rigged vessel.
2. Annen	Germaniawerft, Fr. Krupp, Kiel	Fr. Krupp, Essen						
3. Buckau	" "	"						
4. Datteln	" "	"						
5. Gaarden	" "	"	47.48 x 9.03 x 4.10 456 R. T. 635 tons	1 x 160 e.H.P. 6.5 knots	6 x 260/360	Diesel 4-cycle	Maschinenfabrik, Augsburg, Nürnberg	Engines built for submarines. 3 masted schooners.
6. Hannun	" "	"						
7. Kallisto	" "	"						
8. Christa	Germaniawerft, Fr. Krupp, Kiel	Marine Reederei, Lübeck		1 x 35 e.H.P. 6 knots	2 x 210/250	Crude-oil 2-cycle	Apenrader Motorenfabrik, Apenrade	
9. Baldur	" "	Fr. Krupp, Essen		1 x 35 e.H.P. 6 knots	2 x 210/250	" " "	Apenrader Motorenfabrik, Apenrade	
10. Wiking	" "	" "	27.92 x 6.29 x 3.09 125 R. T. 175 tons	1 x 35 e.H.P. 6 knots	2 x 210/250	" " "	Hanseat. Motorenfabrik, Bergedorf	Schooners.
11. Gustav Adolf	" "	A. H. Schwedersky, Meusel		1 x 50 e.H.P. 7 knots	2 x 250/290	" " "	Allgem. Elektr. Ges., Berlin	
12. Mary	" "	Atlantic Reederei, Hamburg		1 x 35 e.H.P. 6 knots	2 x 210/250	" " "	Apenrader Motorenfabrik, Apenrade	
13. Elisabeth Seumenicht	Germaniawerft, Fr. Krupp, Kiel	F. Seumenicht Itzehoe					Apenrader Motorenfabrik, Apenrade	
14. Hans Ulrich	" "	Tänicke u. Dietrich Prerow	30.26 x 6.78 x 2.40 139 R. T. 195 tons	1 x 35 e.H.P. 5 knots	2 x 210/25	" " "	Hanseatische Motoren Ges. Bergedorf	
15. Christine Jensen	" "	J. H. Jensen Hamburg					"	Galleasses.
16. Gertrud Stein	" "	J. H. Jensen Hamburg					"	
17. Tröndelse	" "	Fr. Krupp, Essen					"	
18. Beta								
19.								
20. Alpha								
21.								
22.								
23.	Germaniawerft, Kiel	W. Treitschke u. Co. Kiel Fr. Krupp, Essen	23.79 x 5.63 x 2.30 78 R. T. 110 tons	1 x 25 e.H.P. 5 knots	1 x 240/280	Crude-oil 2-cycle	Hanseat. Motoren Ges., Bergedorf	Galiots
24.								
25.								
26.								
27.								
28.								
29. Emmi Stein	Smit u. Sohn, Westerbrock	J. H. Jensen, Fleusburg	33.95 x 7.29 x 3.20 211 R. T.	1 x 50 e.H.P. 6 knots	2 x 310/320	Hotbulb 4-cycle	Smit u. Sohn, Westerbrock	Schooner
30. Gerhard Barg	Neptun, A. G., Rostock	Otto Zelk, Rostock	37.55 x 8.54 x 3.83 359 R. T.	1 x 150 e.H.P.	4 x 260/370	Diesel 4-cycle	Benz. u. Co., Mannheim	3 masted schooner.
31. Heimat	Heinr. Brandt, Oldenburg	F. H. Bertling, Lübeck	29.20 x 7.23 x 3.10 152 R. T.	1 x 90 e.H.P.	2 x 335/350	Crude-oil	Deutsche Kromhout Motorenfabrik Brake	3 masted schooner.

IV Motor Vessels Completed

32. Helene Jensen 33. Anna Jensen	Schiffswerft Janssen u. Schmilinski, A. G., Hamburg	J. H. Jensen, Hamburg	32.76 x 7.00 x 3.25 232 R. T.	1 x 70 B.H.P.	2 x 300/360	Crude-oil 2-cycle	Fahrzengfabrik, Ensenach	Schooner.
34. Rebecca	D. W. Kremer, Elmshorn	D. W. Kremer, Elmshorn	34.30 x 7.10 x 3.00 203 R. T.	1 x 120 B.H.P.	4 x 215/320	Diesel 2-cycle	Benz u. Co., Mannheim	3 masted schooner.
35. Violet	Schiffswerft, Janssen und Schmilinski, A. G. Hamburg	Paul Puls, Hamburg	31.50 x	1 x 70 B.H.P.	2 x 300/300	Crude-oil 2-cycle	Fahrzengfabrik, Eisenach	Schooner.
36. Georg Kimme 37. Franziska Kimme	Reconstructed A. G. Weser, Bremen	Friedr. Kimme Bremerhaven	61.40 x 9.09 x 5.40 786 R. T.	2 x 100 B.H.P.	....	....	....	
38. Elsbeth 39. Charlotte	H. Pauksch Landsberg	Skandinavia Schiffahrts Ges., Hamburg	42.03 x 9.02 x 3.09 425 R. T.	......	......	......	....	

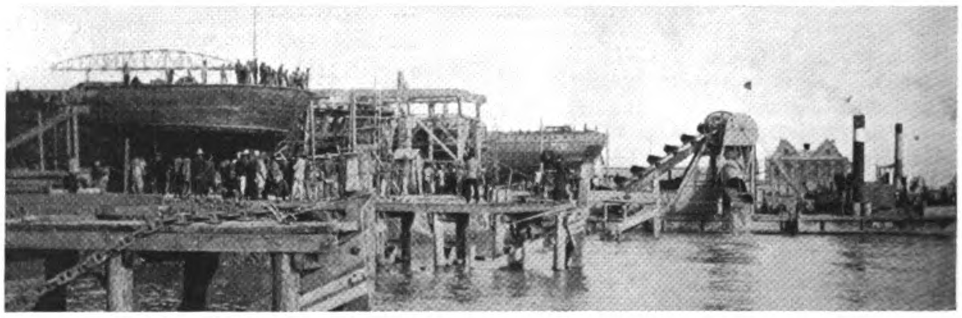
V Motor Sailing Vessels Building

40.	Germaniawerft	....	77.x 13.45 x 66.00	1 x 350 B.H.P.	4 x 400/550	Diesel 2-cycle	Germainawerft,	4 masted barks.
41.	Fr. Krupp,	....	1850 R. T.	6.5 knots			Fr. Krupp, Kiel	
42.	Kiel	....	2400 tons					
43.		....						
44.		....						
45.	D. W. Kremer	Rhederei Rheinland,	50.62 x 8.3 x 4.0					3 masted schooners.
46.	Elmshorn	Duisburg	....					
47.			500 tons					
48. Greif	....	Stettiner Reederei	....	11 x 60 B.P.S.	......	Diesel 2-cycle	....	

MOTORSHIPS BUILT IN CHINA

A short time ago, at Hsin-Ho, near Tientsin, on the banks of the river Pai-Ho, the first ship-building yard in Northern China was opened. It is true that the work carried out is, for the moment at least, rather of a primitive character, and as can be seen from the illustration, only wooden ships are constructed.

Five sailing-ships can be seen in the illustration. They are all of the same dimensions and were built to the order of the "Société Maritime et Commerciale du Pacifique" of Paris. Each has 2000 tons dead-weight carrying-capacity. For the present it is intended to equip two of these sailing-ships with Sulzer two-cycle reversible Diesel marine-engines of 420 h.p.



Five 2,000 tons d.w.c. wooden sailing-ships building in China, two of which are having Sulzer 420 b.h.p. Diesel-engines installed as auxiliary power.

Oil Engined Work Boats

DOWN-EAST FISH-CANNERS USE MANY OIL-ENGINES

On the Maine, New Brunswick and Canadian shores are located a great number of fish canning and packing establishments, gathering the sardines and herring in great quantities. Formerly a great many steamers and gasoline craft were used, but these are becoming more scarce each year, oil-engines being almost solely the power used. To mention fully the extent of the use of oil-engines in these vessels would require pages and at this time we will simply mention a few which have come to our notice, all installations by Fairbanks, Morse & Co.

Lawrence Brothers, of North Lubec, Maine operate the "Muriel" of 55 hogsheads capacity, 71 ft. long, 14 ft. breadth, 8 ft. depth, built by Hodgdon Bros., East Boothbay, Me. A 60 h.p. Fairbanks, Morse oil-engine drives her at 10 knots speed.

The Booth Fisheries Co., Eastport, Me., operate among other craft two-sister-ships, "Patriot" and "Black Diamond," each 64 ft., 5 in. long, 15 ft. 9 in. breadth, 5 ft., 8 in. depth, 60 hogsheads capacity, built 1918-19. Sixty h.p. surface-ignition oil-engines drive these vessels on a fuel-consumption of 5 gallons per hour.

Globe Canning Co., North Lubec, Me., have a 45 h.p. engine in the "Irma" of 60 hogsheads capacity, 63 ft. long, 13 ft., 5 in. breadth, and 6 ft., 2 in. deep, built by George Greenlaw of Eastport in 1918. A speed of 10 knots is obtained.

The E. A. Holmes Packing Co. own the "Eva H," which has a 45 h.p. oil-engine, driving this 65 ft. by 14 ft. by 5 ft., 6 in. vessel. She has a capacity of 60 hogsheads and was built by Walker at Ellsworth, Me., in 1919.

Connors Bros., Black Harbor, Charlotte County, New Brunswick, 12 miles from Eastport, own a large fleet, among which is the "Brunswick Maid," built in 1920, 78 ft. by 17 ft. by 6 ft. deep, powered with a 45 h.p. oil-engine which drives her at 9 knots speed, capacity 60 hogsheads. The "Page" operated by this company is a 65 footer of 55 hogsheads capacity and has a 60 h.p. oil-engine.

The "Kingfisher," owned by the Underwood Packing Co., of Jonesport, Me., has two 75 h.p. oil-engines. This vessel was built in 1908 and has been operated ever since with another type of internal-combustion engine until recently when an oil-engine installation was made. She is 74 ft., 5 in. by 17 ft., 4 in. by 7 ft., 2 in., with a capacity of 100 hogsheads. She makes 10 knots.

"Kingfisher," owned by Underwood Packing Co. Powered with two 75 h.p. Fairbanks, Morse engines

SAN FRANCISCO HARBOR COMMISSIONERS ORDER NEW DIESEL-BOAT

The Board of State Harbor Commissioners for the Harbor of San Francisco have placed the contract for an oil-engine for the new inspection and tow-boat with the Enterprise Engine Company, of that city. This new boat has been designed by D. W. & R. Z. Dickie and is to be of the following dimensions:

Length over-all	57 ft.
Breadth over-planking	15 ft.
Depth of hold	6 ft., 2 in.
Draft	6 ft., 3 in.

The Enterprise Diesel-engine selected is their 100 h.p. four-cylinder 9¼ in. by 14 in. engine turning at 318 r.p.m. which will develop well over 100 h.p. on a consumption of 0.405 lb. per h.p. hour, using 18.37 deg. Baumé oil. As compared with a distillate-engine a little figuring developed that the latter would only have to operate 1 hour and 12 minutes per day for 300 days a year for it to cancel-out the advantage in first-cost, as the fuel cost of the distillate-engine is 349 times that of the Diesel-engine.

ANOTHER FISHING BOAT WITH OIL-ENGINE

Following the trend of the time caused by the general realization among fishermen that although higher in first cost the oil-burning, heavy-duty engine is the cheapest in the end. Captain John Sater, principal owner of the auxiliary schooner "Viking" of New Bedford, Mass., recently has equipped his vessel with a 40-50 B.H.P. two-cylinder Bolinder engine of the direct reversible type.

"Viking," auxiliary fisherman with Bolinders engines

The schooner "Viking" was built at Noank, Conn. in 1897 and has since twice been equipped with 25 H.P. gasoline engines. She is 48 ft. in length, 16.1 ft. breath and 7.6 ft. depth, being registered at 27 gross tons and 19 net tons. While her gasoline engine equipment hardly gave her a speed of more than 3 miles an hour, the Bolinder oil-engine when taking the vessel over a measured course in New Bedford Harbor on October 27th last, increased this to 7 miles with a Columbian bronze propeller 34 in. diameter by 28 in. pitch, turning at about 440 r.p.m.

At full-load the engine consumed just 3 1/3 gallons of fuel an hour at 7 cents a gallon at which price this oil is now obtainable, this therefore means an outlay of 3 1/3 cents a mile. Add to this the cost of lubricating oil, approximately 1/7 of a gallon an hour at about 58 cents a gallon, that is 1 1/5 cents a mile, and a total outlay of 4½ cents a mile for operating this engine at full load is arrived at.

During the course of a year these vessels log in the neighborhood of 20,000 miles averaging two trips in three weeks, while working and running the engine about 100 hours a trip. Fuel and lubricating oils consumed during a year's activities therefore amount to about $900 with which there must be compared the expense of fully three times this amount to operate the gasoline-engined vessel.

ECONOMY IN RIVER-FREIGHTER OPERATION

90 Per Cent Saving in Fuel Cost; 15 Per Cent Less Power; 15 Per Cent More Speed

Trial-trips of the little river-freighter "Suisun City" owned by Hunt-Hatch Company, of Oakland, Cal., have recently been held, after two 65 h.p. twin-cylinder 12 in. by 12 in. Atlas distillate-engines had been removed and two 55 h.p. three-cylinder 8 in. by 10½ in. Atlas-Imperial Diesel-engines had been installed in their place. The change was made simply in the interests of economy. This freighter is:

Length over-all	84 ft. 5 in.
Breadth	23 ft. 5 in.
Depth	6 ft. 5 in.
Tons, gross	142 tons
Tons, net	73 tons

The following data on the performance of the boat before and after having this change of machinery made is exceedingly interesting as showing in black and white why the Diesel-engine, even in small units, must furnish the power in our harbor and coastwise fleets.

Propeller with distillate engines, 48 in. d., 44 in. p., 232 r.p.m.

Propeller with Diesel engines, 44 in. d., 38 in. p., 340 r.p.m.

Speed of boat with distillate engines, 8 miles per hour.

Speed of boat with Diesel engines, 9.2 miles per hour.

Fuel cost with distillate engines per hour. $3.22

Fuel cost with Diesel engines per hour.. 0.30

Actual fuel-consumption with Diesel-engines is 4¼ gals. per hour with 2 engines and 2⅛ gals. with 1 engine. Fuel used costs 6 cents per gal.

This is but one of many conversions from distillate to Diesel-engines which the non-availability of distillate fuel and the added economy of the latter type engine has made necessary on the Pacific coast.

NEW DESIGN OF OIL ENGINE FOR PASSENGER MOTOR-VESSEL

Now under construction at a Puget Sound yard is a twin screw passenger motorship in which two of the newly designed 125 b.h.p. surface-ignition oil-engines built by the Clift Motor Co. of Bellingham, Wash., will be installed. The vessel will operate between Bellingham and the San Juan Islands.

ANOTHER SUB-CHASER SOLD

We are advised that Henry A. Hitner's Sons Co. of Philadelphia, who purchased a great many ex-Navy submarine chasers from the government, have sold Submarine Chaser No. 71 to Mr. C. A. Cromwell, who will convert her into a yacht.

HALIBUT SCHOONER "ATLAS" TO HAVE DIESEL-ENGINES

Peter Wold's 65 ft. halibut schooner "Atlas" is having a 55 b.h.p. Atlas Imperial airless injection Diesel-engine installed. This boat is a Puget Sound craft.

"Patriot," owned by Booth Fisheries Co. Has 60 h.p. surface-ignition oil-engine

ANOTHER ECONOMICAL ATLAS-IMPERIAL INSTALLATION

According to a sworn statement issued by Capt. P. W. McAllister of San Pedro, Calif., the motor workboat G. W. powered with an 80 b.h.p. Atlas-Imperial Diesel-engine showed a fuel-consumption of under 18 cents per hour on a 48 hours' run from Long Beach, Calif. to San Pedro, and return.

"MOTORSHIP'S YEAR BOOK FOR 1922

If you have not already done so, we suggest that you delay no longer in ordering your copy of the Motorship Year Book for 1922. Its price is only one dollar.

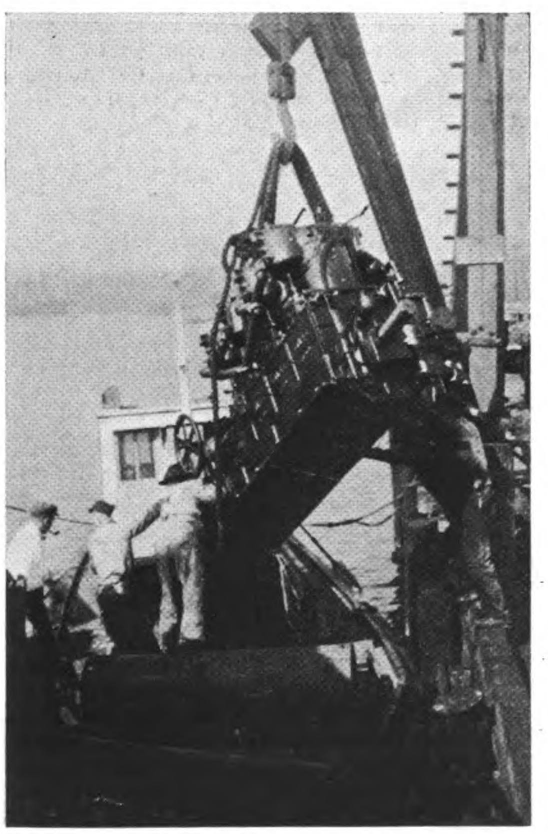
Remarkable Economies Effected by Diesel-Driven Tugs

Actual Results Which Have Been Obtained in Operation of Two Boats

On page 727 of our September issue we illustrated the "Colon," a harbor-tug owned and operated by the Oakland Launch and Tugboat Co. at Oakland, California. This tug has been in operation for more than six months in continuous-service and during this time has never been laid-up on-account of engine-trouble. In fact, we are told by the Atlas-Imperial Engine Co., of Oakland, builders of the 55 h.p. Diesel-engine installed in the "Colon," that the engine has never been dismantled, never had a hot-bearing, no mechanical-troubles, heads have never been removed or fuel-valves touched, the only work done on the engine being to clean fuel-strainers and nozzles. Six to eight weeks elapse between nozzle cleanings.

Crude-oil of 24 deg. specific gravity costing 6 cents per gallon is used, so that the fuel-cost per hour is only about 17 cents. One gallon of lubricating-oil is sufficient for about 20 hours steady-running.

Small steam harbor-tugs of the approximate size of the "Colon" are coal-burners in the true sense of the word, for they burn enough coal to bring their fuel-bill to a figure of 2½ lbs. per brake-horse-power hour under the most economical condition, more often 3 lbs. per b.h.p. hour as against 0.405 lb. per brake-horse-power hour for the "Colon." On the Pacific coast of the United States oil-fuel is so near at hand, consequently more reasonable in price than coal, that for many years previous to the active development of the small Diesel and surface-ignition oil-engine the distillate engine enjoyed a very large degree of popularity being installed not only in commercial craft but in pleasure boats as well. Probably in San Francisco Bay more distillate-tugs have been put into operation than on any other body of water on the whole United States coast. But, distillate fuel is gradually being removed from the market and Diesel-engines are being installed in the place of distillate engines, although the former are operating with perfect satisfaction so far as everything but economy is concerned.



Lifting out the Atlas distillate engine from the tug "HALCYON."

Quite likely the performance of the Diesel-engine in the "Colon" for the past six months or more has influenced the change in the case of the tug-boat "Panama" owned by the same company that owns the "Colon," the two being somewhat similar craft. An 85 h.p. 3-cylinder Atlas distillate-engine is being removed from the "Panama" and a 125 h.p. Atlas-Imperial Diesel-engine is being installed, the increase in power being made not because the Diesel-engine is not as powerful as the other, for it is even more effective, horse-power for horse-power, but because by reason of the extreme-economy of fuel-consumption of the Diesel-type engine it is possible to have more power for less fuel-cost and a little extra power is valuable in a tug. So with the Diesel-engine the owners buy power without eventually paying for it.

We also illustrate the harbor-tug "Halcyon," owned by A. V. Rideout Company, San Francisco, coming up to the Atlas-Imperial dock at Oakland to have her 150 h.p. 4 cyl. 12 in. by 12 in. Atlas distillate-engine removed and a 125 h.p. 3 cyl. 10½ in. by 14 in. Atlas-Imperial Diesel-engine installed in its place. She will save $745 per month with the Diesel-engine. Her distillate bill has been $825 per month; her fuel-oil bill with the new engine will be only $80 per month.

Motor-tug "HALCYON" now powered with a 125 b.h.p. Atlas Diesel engine, the old Atlas distillate engine having been removed for economy purposes.

The "Halcyon" is of the following dimensions: Length over-all, 48 ft., 2 in., breadth 14 ft., 5 in., depth 5 ft., 8 in. Trial trips of this boat with the Diesel-engine installed were run on Nov. 9th, with the following results:

Propeller used....3-blade 53 in. diam. 48 in. pitch
Revolutions tied to dock..............270 r.p.m.
Revolutions running..................330 r.p.m.

The 150 h.p. distillate-engine formerly turned the same propeller as follows:

Revolutions tied to dock.............240 r.p.m.
Revolutions running...................285 r.p.m.

In view of the above proven, economy and desirability of the oil-engine for tow-boat use in actual hard-service day-in and day-out it is a mystery why tow-boat firms, especially on the Eastern-coast of the United States, continue to use the un-economical steam-tug. Not only is the fuel-cost so much higher, but stand-by expense, larger crew, greater heat and dirt, greater time required to get under-way and high smoke-stack are added to the unfavorable steam-tug side of the story. If the internal-combustion engined tow-boat could not do the work that the steam-tug does economy would amount to nothing. But, she can do and is doing exactly that work. When will the rest of the steam tow-boat companies see the light?

INTEREST IN BARGE CANAL TRANSPORTATION

None need worry about lack of interest in our inland waterways and barge transportation on the part of the general public. At the Marine Show just held in New York City there was a booth devoted to these subjects and at any hour of the day or evening more people crowded around in that booth than in any other single exhibit. The representative of "Motorship" was pleased to hear our recent series of articles on the Barge Canal spoken of with appreciation. There is no doubt that the public wants to see our inland waterways transportation developed.

TO BUILD BIG MOTOR FISHING-BOAT

The Arthur D. Storey Shipyard at Essex, Mass., has resumed work on a 400-ton three-masted schooner on which work was suspended last March. The plant is also making preparation to build a fishing schooner this fall.

DELIVERY OF TRAWLER "MUNKTELL"

A 66-ft. motor trawler named "Munktell" has recently been delivered to M. Lefournier, of Port-en-Bessin. She was built at Caen and is propelled by a Munktell surface-ignition oil-engine of 60 b.h.p. at 375 R.P.M.

CAREY DAVIS CO. CONVERT TUG "EQUATOR"

In our August issue we stated that the Carey Davis Tow Boat Co. of Seattle, Wash., would gradually convert their steam-tugs to oil-engine power, commencing with the "Equator." They have placed an order for a 200 b.h.p. Fairbanks-Morse surface-ignition oil-engine and the order for converting the boat has been awarded to J. C. Johnson, boat-builder, Port Blakely Wash.

OFF TO EUROPE

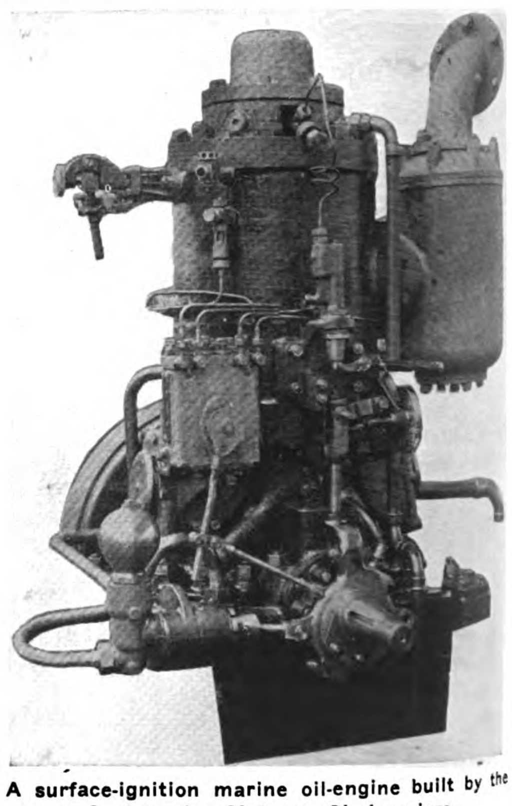
With a view to spending the winter studying the latest development in European Diesel engine construction, Mr. T. M. Holme of the Ingersoll-Rand Co. is leaving for England and Scandinavia.

NEW MOTOR-BARGE IN IRELAND

The new 72 ft. by 15 ft. motor-barge "Cambrais," owned by a large firm of flour millers, has just been put into operation. She was built by Messrs. W. J. Yarwood and Sons, Ltd., of Norwich, England, and is driven by a 40 h.p. surface ignition Robey oil-engine. The carrying capacity is about 60 tons on a draft of 4 ft. 6 in.

"NEPPO," A NEW STEEL AUXILIARY SCHOONER.

Van de Kuy and Van de Ree, ship-builders of Rotterdam recently launched a 300 tons d.w.c. steel auxiliary named "Neppo" for Van Oppen & Co. She has a four-cylinder 150 b.h.p. Kromhout oil-engine.



A surface-ignition marine oil-engine built by the Societe des Moteurs Chaleassiere.

Interesting Notes and News from Everywhere

ACTION STARTED ON "MOTORSHIPS" NEW PLAN

Twenty Shipping Board vessels of various types and tonnage are to be offered to operators who will agree to install in them Diesel propelling-machinery to be purchased from the government, Admiral Benson, commissioner in charge of construction and machinery efficiency of the Board, announced on December 1st. "The Board has long recognized the prime necessity of developing Diesel-engine driven tonnage if this country is to take its rightful place as a maritime nation," said Admiral Benson.

MOTORSHIP "LEIGHTON" RUNS TRIALS

Trials of Lamport & Holt's new 11,000 tons d.w.c. Diesel-driven motorship were run on October 13th last. She was built by A. McMillan & Son, of Dumbarton, Scotland, and B. & W. Diesel-engined by Harland & Wolff.

TRIALS OF MOTORSHIP "LINNELL"

Trials of the Diesel-driven freighter "Linnell" have just been run. She is a sister to the "Layton," and was also built and powered by Harland & Wolff, Ltd. She will be operated by the Liverpool, Brazil and River Plate Steam Navigation Company of Liverpool, which is one of the Lamport & Holt Companies.

LAUNCH MOTORSHIP "HALLFRIED"

The 7,200 tons deadweight Werkspoor Diesel-engined motorship "Hallfried" has just been launched at the Rijke yard, Rotterdam, Holland. Two 1,400 i.h.p. engines are being installed.

ANOTHER VICKERS' DIESEL-TANKER LAUNCHED

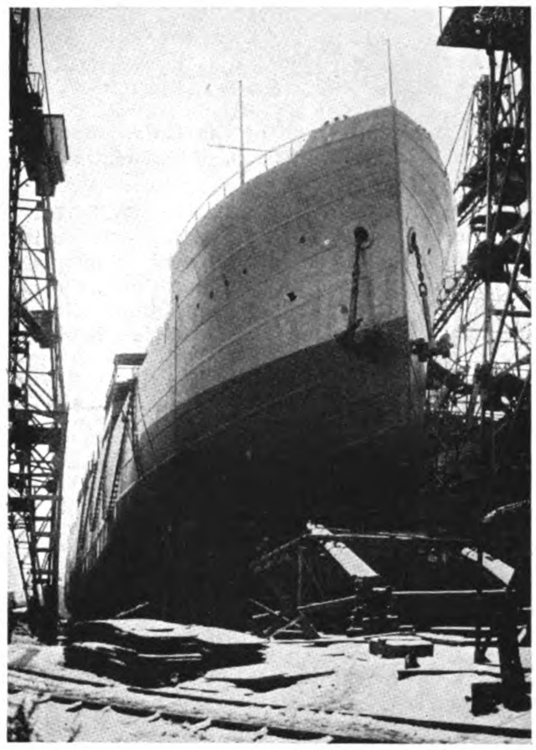
Vickers Ltd., Barrow-in-Furness, England, launched the twin-screw Diesel-driven motor tanker "Scottish Minstrel" on November 15th to the order of Tankers Ltd. of London. This ship is the third of four sister motorships built and building by Vickers for these owners.

REVIEWS

"Lubrication." A Technical Publication Devoted to the Selection and Use of Lubricants. Published monthly by The Texas Company, New York. We have had the pleasure of reading the September and October issues of this attractive little house-organ and feel that every engineer of a motorship would do well to read this interesting booklet each month. These September and October issues contain a general analysis of the Diesel-engine, the four-cycle air-injection type being discussed in the former and the two-cycle solid-injection type being discussed in the latter issue, together with articles on acidity in oils, lubrication of engines, etc. Both issues are well illustrated. We congratulate the Texas Company on publishing such a series of semi-technical booklets in which the subject is handled in such a non-partisan spirit and in which Texas products are effectively yet not obtrusively advertised.

ENGINE TESTS OF STANDARD OIL CO.'S MOTORSHIP

For testing the two 1140 I.H.P. (850 shaft h.p.) Werkspoor-Diesel engines of the Standard Oil tanker "H. T. Harper," the Pacific Diesel Engine Co. of Oakland used 14 degs. Baume oil-fuel. The two engines each developed 1,006 shaft h.p. at 135 R.P.M., and together used 54 barrels per 24 hour day. Sea trials of this ship are given elsewhere in this issue.



Motorship "Laponia," second of the Diesel-driven ore-carriers for the Oxelosund-Grangesburg and sister to the m.s. "Strassa" just prior to her launch at the Gotaverken Goteborg, Sweden, on November 5, 1921

GEO. ARMES HEADS RE-ORGANIZED SHIP-YARD

Re-organization has taken place of Mooney & Young of San Francisco, with George A. Armes as president and John Mooney as vice-president, under the name of the General Engineering Company. M. Armes until recently was president of the Moore Shipbuilding Company at San Francisco, and Mr. Mooney was superintendent of construction at the Skinner & Eddy yard at San Francisco during the war. The main work of the plant at the present time will be ship and engine repairs, but later on they expect to undertake ship construction.

DO YOU WANT TO SELL US YOUR YEAR BOOK FOR TWO DOLLARS?

"Motorship" has received so many urgent requests for a copy of the 1921 Motorship Year Book that in order to meet this situation we will gladly buy back at an increase in price of one dollar a limited number of copies in good condition which any owner will part with. Before sending in the "Year Book," mail us a post-card.

AMERICAN MOTORSHIP OPERATES ON 14 BAUME BOILER-OIL

In our Editorial this month we have referred to an American coastwise Diesel-driven tanker that has been successfully using Mexican boiler-fuel of 14 degrees Baumé, which is as heavy and as near crude-oil as any steamship could use with safety.

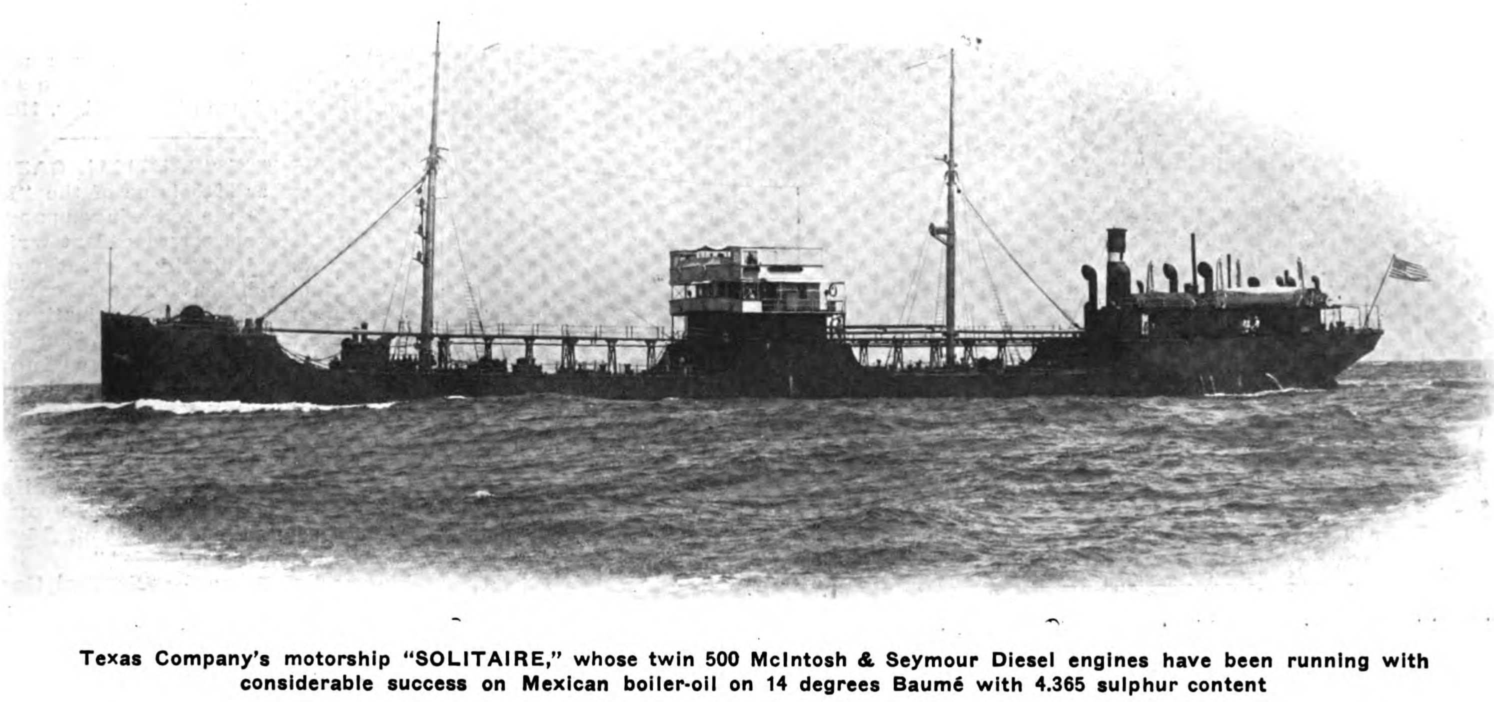
This is the motorship "Solitaire," which was built in the Texas Steamship Company's shipyard at Bath, Maine, went into commission April 20, 1920, propelled by twin 500 shaft h.p. McIntosh & Seymour Diesel engines. Her performance has been very satisfactory, as indicated by following averages for first sixteen months in service.

Average speed (loaded) .... 8.89 knots
Average fuel-consumption...... $38\frac{1}{2}$ bbls. per day
Average cargo .... 4,252 tons
Total distance travelled...... 59,670 nautical miles

During above period the time lost due to machinery overhauls and adjustments amounted to but 15 days, 10 hrs. and 35 mins., less than one day per month. Lloyds annual machinery survey was held in August. At that time a fuel-heating system was installed in which the exhaust-gases were used for heating water, which in turn was employed to heat the fuel. After completion of the installation and survey the "Solitaire" again went into commission using 14 deg. B. to 16 deg. B. gravity fuel-oil, and has since been operating satisfactorily on this grade of oil.

This fuel-heating arrangement consisted of a set of heating-coils in the silencers in which fresh-water was heated by the exhaust-gases. This hot-water is then passed through coils in the fuel-service tanks. In the silencer a coil also has been installed for the auxiliary oil-engines.

When the main-engines are cold they are started and run on 0.92 gravity oil for about ten minutes, then the heavy-oil is turned on. It has a viscosity of 1,000 sec. at Seybolt at 150 Fahr. The main engines have run for over 450 hours at sea on this fuel, and the fuel consumption of the twin 500 brake horse-power engines have been reduced by over three barrels per day. The sulphur had no effect on the exhaust valves.



Texas Company's motorship "SOLITAIRE," whose twin 500 McIntosh & Seymour Diesel engines have been running with considerable success on Mexican boiler-oil on 14 degrees Baumé with 4.365 sulphur content

SINGLE-SCREW MOTORSHIP "SEGOVIA" RUNS TRIALS

The North Eastern-Werkspoor Diesel-engined 3,000 tons motorship "Segovia" recently ran trials.

NEW MOTORSHIPS EXCEED NEW COAL BURNERS

For the first time in history, new Diesel-engine motorship construction in 1920-1 exceeded in tonnage vessels fitted with coal-burning steam-boilers, according to Lloyd's recent report.

MAIDEN VOYAGE OF CONVERTED WARSHIP

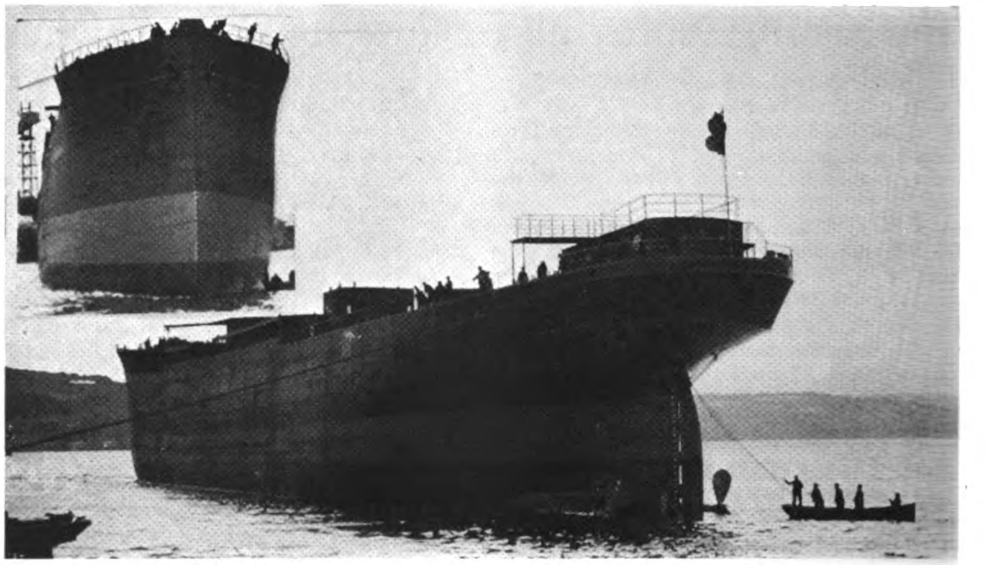
The German Diesel-engined motorship "Odin," converted from a cruiser, recently arrived at Petrograd with a cargo of locomotives. She is owned by Arnold Bernstein and has been described in "Motorship."

TRIALS OF MOTORSHIP "VIRGINIA"

On the 5th of November the motorship "Virginia" ran her trials. She attained a speed of 9.2 knots at 200 R.P.M. on a displacement of 550 tons reversing in 13 seconds. The consumption was 146 grams per i.h.p. hour

TRIALS OF MOTORSHIPS "LOSADA" AND "LOBOS"

The third Diesel-driven motorship constructed by Harland & Wolff for the Pacific Steam Navigation Company has run her trials. This is the "Losada," sister to the "La Paz" and "Lobos." It will be remembered that the "La Paz" visited New York last year and was full described and illustrated in our issue of November, 1920. All three vessels are of 9,190 tons d.w.c. and of 3.200 I.H.P. Harland & Wolff B. & W. Diesel engines are installed. Three larger motorships for the same owners are now under construction. The "Lobos" ran trials during October last.



After the launch of the Union Steamship Co.'s motor-freighter "Hauraki" at the Denny Shipyard, Dumbarton, Scotland. Plans were given in our last issue on pages 880 and 883

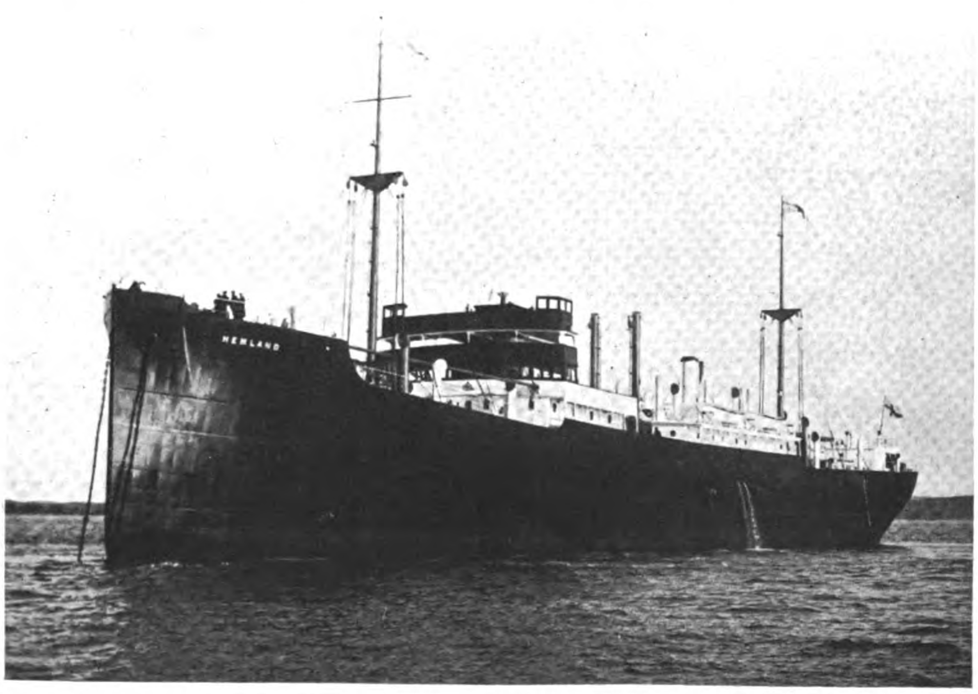
"FURUSTRAND" SOLD TO SWEDEN

The 700 tons deadweight auxiliary "Furustrand" has been sold to Swedish owners. She was built by the Santa Rosa Shipbuilding Corp., Florida, in 1920, and fitted with Fairbanks-Morse oil-engines, to the order of C. B. Nielsen of Skien, Norway.

Launch of the United Steamship Co.'s new Burmeister & Wain Diesel motorship "Louisiana" at the Ardrossan Shipyard

SLOW-SPEED GERMAN DIESEL ENGINES

Blohm and Voss of Hamburg are building a pair of two-cycle Diesel marine-engines of 1,750 shaft h.p. each at 95 r.p.m., which will be installed in a third sister motorship to the "Havelland." These are the engines shown in the drawing on page 871 of our November issue.



Swedish Lloyd's new motorship "Hemland," launched under the name of "Adria" at the Gotaverken, Goteborg. For details see page 735, September, 1921. Trials were run on November 10th

NEW MOTORSHIPS "PINTHIS" AND "PIZARRO"

In our issue of September, 1920, we described two motorships that had been ordered from Wm. Beardmore & Co., Ltd., of Dalmuir, Scotland, by MacAndrews Ltd. of London, for fruit carrying. The first of these vessels, the "Pinzon," was launched on November 15th. She carries about 2,000 tons d.w. and is propelled by Beardmore-Tosi marine Diesel engines developing 1,290 shaft h.p. at 125 R.P.M., or 1,000 shaft h.p. at 105 R.P.M. The name of the sister motorship is the "Pizarro" and she is now on the stocks.

GAS ENGINES FOR SUBMARINES

It is not generally known that a number of twin and triple screw submarines were built for the German Navy during the war, in which gas engines were installed. These vessels were of 100 ft. length, 500 b.h.p. and 14-knots and were fitted with Benz engines. Further details are before us but we are prevented from publishing same on account of pressure on space.

TRIALS OF THE SWEDISH LLOYD MOTORSHIP "HEMLAND"

Built to the order of the Rederiaktiebolaget Svenska Lloyd of Göteborg, Sweden, and launched under the name of "Adria," the new motorship "Hemland," now owned by the Rederiaktiebolaget Tirfing, which is another Dan Brostrom Company, and one of the largest steamship lines in Sweden, ran her sea trials on November 10th. These were carried out without any hitch whatever and the vessel averaged a speed of 12.02 knots, developing 2,812 i.h.p. on a consumption of 0.135 kg. of fuel-oil per i.h.p. hour, the vessel being lightly loaded.

This vessel has a carrying capacity of 8,400 tons on 25-ft. draft and has a bunker space for 1,150 tons of fuel. Accommodation is arranged for twelve passengers. Two Götaverken B. & W. Diesel motors of 1,400 i.h.p. each are installed. Further details of this vessel were published on page 735 of our issue of September, 1921.

—SAYS THE "NAUTICAL GAZETTE"

In the October 29th issue of the "Nautical Gazette" (page 562) the following appears—

> "Our Liverpool correspondent writes that there is undoubtedly a great future for the motor-driven express cargo boat and for motor-driven combination passenger-and-cargo vessels. When equipped with internal-combustion engine power such vessels can attain a speed of sixteen knots without their fuel-consumption exceeding that of an eleven or twelve knots geared turbine steamer of similar dimensions, whilst the absence of boiler-water and the great reduction in the quantity of fuel required enables about 15 percent more cargo to be carried."

We are glad to see the "Nautical Gazette's" correspondent endorse the type of ship recommended to Congress by "Motorship" in February and published in the "Congressional Record," also in "Motorship" for March, 1920.

DEUTSCHE WERFT MOTORSHIP READY IN JANUARY

The motorship "Julius Schindler," 3,700 tons d.w.c., now under construction at the Deutsche Werft, Hamburg, is expected to be placed in service during January next. She is being equipped with a Burmeister & Wain type Diesel-engine of 1,260 shaft h.p. by the A.E.G. of Berlin.

WOODEN MOTORSHIP "OREGON" SOLD

In view of the almost worthlessness of the U. S. Shipping Board's fleet of wooden steamers it is interesting to note that the American wooden motorship "Oregon," of but 1,616 gross tons, has just been sold at a price of $10,000 by U. S. Marshal to the bank of California. She is powered with twin Southwark-Harris Diesel engines.

LAUNCH OF MOTORSHIP "DUMRA"

The twin-screw Diesel-driven combination passenger and cargo ship "Dumra" was launched on November 16th by Charles Hill & Son, Bristol, England, to the order of the British India Steam Navigation Company. This vessel was specially designed for a new service on the African coast and has accommodation for 24 first and 24 second-class passengers, in addition to accommodation for native passengers between decks. She is propelled by a pair of 600 shaft h.p. North British four-cycle type Diesel engines. Length is 280 ft. over-all, 48 ft. 6 in. breadth, and 24 ft. to upper deck. She will have a cruiser-type stern.

INSURANCE OF MOTORSHIPS

Owing to the higher rates asked by Norwegian insurance companies for motorships, owners of oil-engined vessels in that country formed a pool as they consider that the risks involved are not greater than for steamers and so do not warrant higher premiums. In this connection should be pointed out that first-class Danish motorships are covered at the same rates as prevail for steamers. In fact, ship chandlers abroad do not welcome motorships in port as they know from experience that they stand few chances of selling packings or spare parts, as it is only very occasionally that a motorship needs repair.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS' MEETING

During the week of the Marine Show held in New York November 14-19 the general meeting of the Society of Naval Architects and Marine Engineers was held on November 17th and 18th. The attendance was very good, many members taking advantage of the opportunity to inspect the exhibits at the show while in the city for the society meeting. Among the many interesting papers presented were the following in which Diesel-engines featured:

"Kobenhavn," the big Diesel-driven training-ship of East Asiatic Company

"Electric Propulsion of Ships," by W. E. Thau, general engineer, Westinghouse Electric & Manufacturing Co.

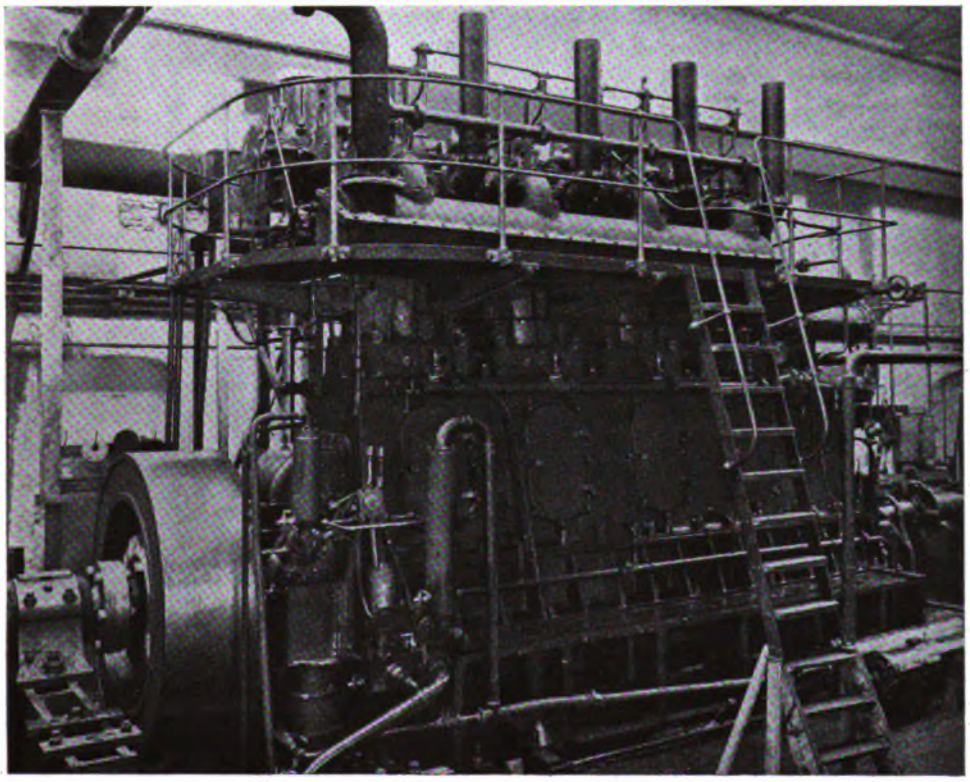
"Electric Auxiliaries on Merchant Ships," by E. D. Dickinson, mechanical engineer, marine department, General Electric Co.

In the former paper the principal types of electric propulsive equipments were analyzed on the score of reliability, maneuvering ability, economy, weight, space, maintenance, cost and operation, with the result that the Diesel-electric drive was found to provide an electric-drive "as reliable as any economical drive, weighing less than any other drive, as economical as the best, in most cases costs less than any other drive, provides more reserve power in case of casualty to prime movers, and affords simplest and most flexible control." Mr. Thau said among other things: "The Diesel-electric has the greatest range of application of any of the economical drives, geared turbine electric not excepted.

Because of the inherent merits of this drive, it is very suitably applied to merchant-ships, barges, river-boats, lake-boats, ferry-boats, small coastwise-vessels, yachts, fishing-boats, coastguard cutters, cable-laying ships, and any ship within its capacity requiring refined control and economical operation over a wide range of speed. As compared with any type of steam drive, the principal advantages of the Diesel-electric are: Fuel-consumption; weight; control; considerably more reserve power."

An animated discussion followed the reading of this paper, going into the question of the suitability of induction and synchronous motors, comparisons of steam and Diesel-electric drive, etc., and it was noted that only one speaker talked in favor of steam as against the Diesel-drive. The concensus of opinion among engineers agrees with the conclusions reached by Mr. Thau quoted above.

Following the reading of Mr. Thau's paper Mr. Dickinson presented the paper on "Electric Auxiliaries on Merchant Ships." The advantages and saving in cost of operation of electric-winches over steam-winches were covered in this paper. Referring to the motorship Mr. Dickinson said: "Because electricity makes possible many reductions in the cost of operation and at the same time enhances the earning power of a ship, it is being used to a never-increasing extent for driving the machinery on ships. On highly efficient new ships, especially motorships, practically all the auxiliaries are driven by electric motors. In the motorship the steam-boiler becomes an auxiliary, and it is apparent that much of the gain in economy secured by the oil-engine would be sacrificed if steam auxiliary machinery were retained. In the steamship, the losses incident to the steam auxiliaries are not so apparent; nevertheless, they are there, a constant drain on the boilers and a continual handicap to any operator or engineer endeavoring to attain efficiency in operation. It is recognized that a somewhat greater gain in fuel-economy is generally secured on a motorship by the adoption of electricity for the reason that Diesel-engines are employed to drive the generators."



The 600 b.h.p. non-reversible Burmeister & Wain Diesel engine of the "Kobenhavn"

COMING TECHNICAL PAPERS

The North East Coast Institution of Engineers and Shipbuilders, at their meetings of the current session will have many papers, the following among them being of interest to those having to do with Diesel engines:

"The Use of Compressed Air in Diesel-Engine Ships," by Mr. William Reavell. To be read on Jan. 13, 1922.

"Marine Diesel and Marine Oil Engines," by Mr. K. O. Keller, to be read on Jan. 27, 1922.

"Running Costs of Diesel-Engined Ships," by Mr. F. Madsen, to be read on Feb. 24, 1922.

"Diesel Engine Design," by Mr. Paul Belyavin, to be read on March 20, 1922.

VARIATIONS IN DIESEL-ENGINE DESIGN

A paper on variations in Diesel-engine design, illustrated by lantern slides of over 20 leading makes, was given before the Pennsylvania section of the Society of Automotive Engineers on November 22nd at the Engineers' Club, Philadelphia, by the Editor of "Motorship."

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed)

—SAYS A SHIPYARD ENGINEER BACK FROM EUROPE!

To the Editor of "Motorship":

I returned from Europe last Sunday, but while over there I did not have as much time as I would have liked to investigate marine Diesel-engines and motorships. I, however, have no hesitation in saying that the next few years will see a great advance in this direction. Shipowners who a few years ago would not listen are now very much interested and the shipyards and engine shops are either building or getting ready to build this class of vessel.

One large shipyard I visited is building a standard 3,000 h.p. engine to fit their standard 12,000 tons d.w. vessels, and are confident that in the very near future they will receive orders for the Diesel-type of engine to replace the steam power plants at present installed in existing standard vessels.

There are several types of engines and it is a difficult matter to decide which is the best as the general opinion of engineers is divided. But, I am confident that within a year or possibly two years we will have motorships with machinery perfectly reliable and operating at a very much lower cost than at present.

From what I saw and heard, I find that we have got to push ahead faster than we are at present if we want to stay in the race and keep the American flag on the sea.

J. S. MILNE,
Chief Engineer,
Todd Shipyards Corp.,

25 Broadway, N. Y. C.
August 18, 1921.

MOTORSHIP "CHARLIE WATSON" IS RELIABLE SAYS HER ENGINEER

Aug. 29, 1921

To the Editor of "Motorship,"

I have read with much interest your great effort in bringing-out through the columns of the "Motorship" absolute facts and true statements as regards the "future propelling-power for ships."

My experiences with steam, gas and producer-gas engines mostly marine installations, dates back to 1900, and it surely was a "He-Man's" job to keep some of those "installations" in operation at that date.

At the present time I am in charge of my first Diesel installation, and what I can say of this is as follows—reliable, economical and very interesting, and a "power" that must have a wonderful future.

FRANK COULTER

M/S "Charlie Watson,"
At Sea, Off Pacific Coast.

[The "Charlie Watson" is a twin-screw tanker propelled by two 640 I.H.P. Werkspoor Diesel-engines built by the Pacific Diesel-Engine Co. of Oakland, Cal.—*Editor.*]

"SOLID INJECTION," "MECHANICAL INJECTION" AIRLESS-INJECTION, PUMP-INJECTION OR "UNMIXED VAPORIZATION"?

To the Editor of "Motorship":

For everything that is apt to grow in importance it is advisable to have it well named, that is to say, to avoid any denomination that may give rise to error as regards its character. Many of your readers will agree with me that the name of "Solid-injection," which is widely used for the system of vaporizing fuel without the aid of air under pressure, is not wholly justified by the character of the system. Far from being "solid," the fuel spray has, on the contrary, to be as finely spread as possible, and so the name "solid-injection" cannot satisfy.

In another sense the same is the case with the denomination "Mechanical-injection." With air-vaporization the process has to be regarded as a mechanical one too (the air is compressed mechanically); so the term is not justified and gives no exact indication as to the character of the system.

It has to be recognized that it is not very easy to give a word that will satisfy all, but I have endeavored to seek a denomination that rightly indicates the system and present it to the wide circle of your readers. In my view, "*Unmixed Vaporization*" is a right indication for a system, where the vaporization of the fuel is acquired without mixing it with air or another gaseous agent. Possibly one of your readers may present us a still better word. No doubt many of your readers would be pleased with it as well as

S. SNUYFF,

Bloemendaal, Holland.

[Pump-injection has been proposed. Another good suggestion made is "Airless-injection." Further correspondence on this subject will find space in our pages.—*Editor.*]

INSPECTION OF MOTORSHIP MACHINERY

To the Editor of "Motorship,"

If we are to keep on building larger and better motorships, why doesn't someone start a campaign for the establishment of separate inspectors for the machinery of motorships. I imagine the inspectors of boilers have their hands full attending to the steamships and examining candidates for steam engineer's licenses. We all know that small American motor vessels are often sent to sea in a condition that dooms them to failure from the start.

I have the most profound respect for the work that has been done and is being done, for the steamships, by the inspectors of boilers. And also I greatly admire the type of men usually found occupying the positions of inspectors of boilers and in charge of the machinery of our big steamers. I wish the "motorship game" had more engineers of the type of old school steam-men. However, is it well for motorships to be inspected and motor engineers examined and licensed by men who, in many cases, have never seen an oil-engine and, in most cases, have never operated one?

JOSE E. MERRILL

M. E. B. A. No. 49,
San Francisco, Cal.

SIXTY-ONE DAYS' NON-STOP RUN

To the Editor of "Motorship":

I've never read an article or notice about the auxiliary "La Merced." Tho very badly underpowered, I believe this little vessel is one of the most reliable auxiliaries under the American Flag, as far as her power-plant is concerned. She is about 1,650 tons net register and is equipped with two 160 H.P. Bolinder oil-engines. She is about five years old and, tho she broke a crankshaft on her first trip, she hasn't had a bit of important repair work since except the usual overhauling for cleaning purposes. We have just finished a voyage from Australia during which the port engine ran continuously from Newcastle to Frisco without a stop for 61 days. The starboard engine was stopped 24 hours by captain's orders, due to good wind. The Bolinder agents here tell us that the 61 day continuous run of the port engine established a new record. Incidentally, after a voyage to four different ports in New Zealand and two in Australia, nine months altogether, we have cleaned out the cylinders, made the few minor repairs necessary, with only the ship's three engineers and are at sea again 11 days after coming in from Australia.

We laid nearly three months in Newcastle for cargo, during which time we never touched the engines except to run them about an hour once a week to keep them limbered-up. I think the success of this ship has been largely due to the fact that the engines are installed on long, heavy iron beds.

There have been two or three cylinder-heads cracked. But a cracked-head doesn't necessarily mean a shut-down on a Bolinder job. We ran 30 days with a cracked-head and could have just as easily run 30 days longer. We repair them by shrinking a steel band around the circumference of the head.

Referring to the letter from Mr. Haggett of M. E. B. A. No. 52, published in your July, 1921, issue, I want to say "More power to you, Brother Haggett, you've got the right idea." There has seemed to be a general impression heretofore that the main requisite for a good oil-engineer was a well-defined foreign accent. Wishing all success to you and your excellent magazine—

JOSE E. MERRILL

M. E. B. A. No. 49,
San Francisco, Cal.

REVERSING RUDDERS FOR CANAL BARGES

To the Editor of "Motorship":

In view of our Kitchen patent reversing-rudder, I am greatly interested in the article appearing on page 720 of the September issue of "Motorship" under the heading of "Economical Transportation on the New York State Canal" in which it gives a very good reason why it is thought that twin-screw installation should be employed as a propelling unit on the type of barges shown in Figure 1, page 720. The article also states that "In Canal operation long non-stop runs at full power do not occur. The difference between the essentially intermittent service required on the Canal and the long, hard grind, say, of a transatlantic voyage, etc., etc."

You will readily realize the importance of the part which the reversing rudder will play in Canal transportation. For example, the same long non-stop run as the large ocean-type of vessel makes can be attained by a single internal-combustion engine on a canal barge for the reason that at the beginning of the run the engine can be started and kept continually in motion until the barge reaches her destination. Further, with the Kitchen rudder the engine is always under a constant load and rotating in one direction only, i.e., ahead, and a single screw barge can be operated in such a manner as to outmanoeuvre any twin screw barge afloat without interfering with the continued ahead operation of the engine and propeller. Again, regardless of the block co-efficient of the barge and as long as there is a stream line to the single propeller, a barge will handle as efficiently as a fine-lined craft.

No doubt you are aware that any vessel equipped with this rudder is under perfect control without being under steerage way. For example, a barge can be rotated on its own axis, as if on a pivot, to either port or starboard without progression. This, I do not think, can be attained even by a twin-screw installation. As the Kitchen rudder is solely a one man control the navigator can handle and manoeuvre his craft through the various locks and canal bends without having to slow down or reverse his engine or propeller and can negotiate a turn even at right angles, from the steering position. This was demonstrated by our motor-cruiser "Violet" on her way from Washington, D. C., to Bridgeport. The boat entered the Raritan Canal and from the time she entered until she left, in passing through locks and in slowing down and negotiating bends, the engine and propeller on this boat were kept running in one direction only and at a steady speed, the engine being at all times under a constant load.

A single-screw engined boat fitted with the Kitchen rudder for canal work would give better steering and manoeuvring ability in the bends and locks of the canal than the twin screw barge with reverse gear. Further the attention necessary for a boat equipped with one engine is much less than would be necessary if two engines were installed. Take for example the canal barge installation as described and illustrated on pages 22 and 23 of the enclosed booklet. This is a reprint from "Canals and Waterways Journal" of May, 1920, as per pamphlet enclosed. This canal barge prior to installation of a comparatively small engine, 25/30 b.h.p., was towed in the usual manner by horses along the canal bank. You can see that since the installation the barge is under one man control and can negotiate bridges and locks in a manner as never before known. Further it helps to prove that no special type of craft need be built to accommodate these rudders as the block co-efficient of this barge is 0.86 which is fully recognized as being more of a box than anything else.

In regard to the diagrams as shown on 720 of the September issue of "Motorship" a single-screw barge of this type equipped with Kitchen reversing-rudders would be much more efficient than the twin-screw barge as described.

THE McNAB COMPANY,
Per, Alexander McNab, President.
Bridgeport, Conn.

OUR NOVEMBER EDITORIAL

To the Editor of "Motorship,"

The editorial in "Motorship" entitled "Wanted a Man of Resolute Purpose, Financially Backed by "Congress" I read with interest and am glad to see that "Motorship" is doing its bit to help along our merchant-marine. There is a big task ahead of us, and I trust you will continue to rouse public interest through your paper.

JOS. E. RANSDELL

U. S. Senate
Committee on Commerce,
Washington, D. C. November 12, 1921.

BUILD MOTORSHIPS—SAYS REPRESENTATIVE EDMONDS

To the Editor of "Motorship"

It was with pleasure that I listened to the speech of Mr. Frank Munson, made during the voyage of the "Southern Cross" from Philadelphia to New York. Mr. Munson is one of our most able shipping operators, and when he praised so highly the "motorship" as the coming vehicle of trade, he only confirmed my convictions made in 1916, and urged by me upon the various chairmen of the Shipping Board, I regret to say without any action on their part. Perhaps it was not possible to carefully develop or study the various motors during the war, with positive assurance of the results desired, but it is now becoming more evident every day that the motor for economy and efficiency is far in advance of any other type of propulsion for shipping. It will be absolutely necessary for us whenever opportunity occurs, or changes can be made reasonably, to endeavor to install and place in operation ships of this type.

In my opinion the future control of commerce will be attained by the nations using this method of propulsion for their ships.

G. W. EDMONDS.

House of Representatives,
Comm. on Merchant Marine & Fisheries,
Washington, D. C. October 11, 1921.

SULPHUR IN LUBRICATING-OIL

To the Editor of "Motorship":

For the past six months I have been in charge of the Diesel-engine end of an ice plant, due to no Diesel motorships calling here for operating-engineers, before I took this place. Records show that we produce more ice that ever before. This plant has two single-cylinder Snow Diesel oil-engines 22½" x 38" and 16¾" x 24" bore and

I am pleased to see something on lubricating-oil in June issue and would like more on lubricating-oil, also on fuel-oils, and if there is a way that an engineer can find out an unreasonable amount of sulphur content without sending a sample away for an analysis. I have a list of 57 grades of different brands of lubricating-oil showing the Baumé, flash, burn, chill and viscosity seconds at 100 F., 150 F., and 212 F. While part of list is old, the last was received a short time ago. I believe more study of oils and fuel will save much trouble on Diesel-engines. Also, another thing that I use here on drains of air-compressor, is a steam-trap to take off a large amount of water that leaks past a new cylinder liner.

Yours very truly,
G. A. PINNEO.

R1, Box 57, Tampa, Fla.

[A comprehensive article on fuel-oils is in our Year Book, now on sale, price $1.00.—*Editor.*]

"MOTORSHIP" APPRECIATED IN FRANCE

(Translated)

To the Editor of "Motorship"

Allow me to convey to you the pleasure that I experience in reading my copies of "Motorship." I am convinced that the merchant-fleet in the future will be composed of a great number of ships with Diesel-engines, and I am pleased to see publications like "Motorship" make efforts to interest shipowning companies to a comprehension of their true interests.

Y. LE GALLON.

Etablissements Delaunay-Belleville,
Saint-Denis-sur-Seine, France.

THE ENGINEER QUESTION

To the Editor of "Motorship,"

Sir—

I have received a copy of "Motorship," and find it to be a most wonderful magazine. I wish to ask a few questions and make a few comments on different articles in the June number.

In the article on the M.S. "William Penn" on page 471, it is stated that shipowners, upon ordering ships motor-propelled, should give their best steam-engineers the chance. All well and good. On page 481, regarding the article on the M.S. "California," let me tell Captain Pedersen that Americans are just as smart, if not smarter, than any Scandinavians. Also it is stated that if more Americans would go to sea, conditions would improve. This is all good dope. But, why don't more Americans go out? Because there are certain rules under which a man must work.

Take the case of the engineer, officers and men of lower grades. If a man would be a marine-engineer, he must swing a shovel for 36 months' sailing time. How many will do that? Very few!

Oil-burning steam plants made that situation a whole lot better. Then when a man goes up for his license, no matter how hard he studied and all that, he is liable to get a flat turn down unless he has some pull or stands in. I have known of cases on the Great Lakes where one man made a round trip from Buffalo to Duluth and return, went up and got papers for 1,800 tons as 1st Assistant Engineer. Another one fired four years and was turned down flat. He was an arduous student, too. There are lots of stationary steam-men who can handle marine plants, but very few marine men can handle stationary plants.

I was with a tug engineer one summer on the Hudson, who could not pass the New York City License Bureau, yet has a thousand-tons ocean license. I do not pretend to be a marine engineer, even if I do hold more than one license. But how are you going to get men who know their business for motorship engineers when you can't get enough steam men. If a man must (according to law) have at least one year's experience as a licensed steam man to be eligible for an oil-engine license, and he should be at least a year with the makers of such engines in all work from making to testing, I fail to see how you are going to man these ships with men who must necessarily have more brains than steam men. I would go as an oiler or helper on a motorship if I got the chance, but as they appear to want all A No. 1 men, I don't see any such chance.

Yours very truly,
R. G. SUMMERS.

Rochester, N. Y.

FROM A SWEDISH READER

To the Editor of "Motorship."

Since I first saw your magazine at the beginning of this year, when together with Mr. Hugo Moren I was an engineer on board the 9,400 tons motorship "Elmaren" during the marine-engineer strike, I have been a very interested reader. I want to express my thanks for several valuable articles. I think, largely due to your efforts, the opinions of American shipowners and shipbuilders are turning to the favor of motorships.

BERT H. BROWALL.

Civil Engineer,
Gothenburg, Sweden.

In view of the present interest in Diesel-electric drive, we are reproducing a photograph of two 6-cylinder 3,000 b.h.p. Sulzer, 2-cycle type Diesel-engines connected to generators at a power station at Bremen. In England and France there are two 4,500 b.h.p. Sulzer Diesel-engines driving electric-generators. Future development with the Diesel-electric drive aboard ships will probably show as many as 6 units of 1,000 to 2,000 b.h.p. each, in conjunction with single or twin screws